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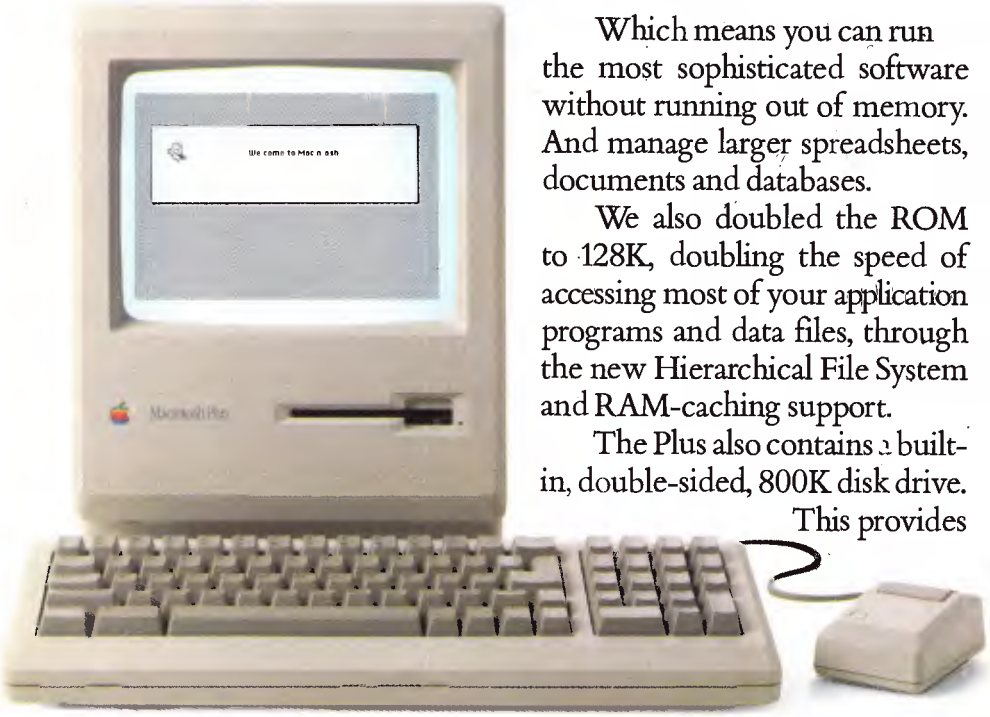
AUSTR ZINE

CHAOS TO COHERENCE

New series: structured programming

New Macintosh Plus. We've added



This year Apple introduces a new Macintosh.

Macintosh Plus.

As the name suggests, it's evolutionary, rather than revolutionary

(It's not our policy to bring out totally new computers for the sake of it. Instead we strive to perfect existing ones.)

Macintosh Plus is as simple to learn and use as before.

But there are some big differences, encouraged, we don't mind admitting, by current Macintosh owners.

Some of you asked for more power, others speed. Some needed greater storage capacity, others expandability.

Some heavy number-crunchers wanted a numeric key pad and conventional cursor keys built into the keyboard rather than remote.

Done. Done. And done.

The pluses of this new Macintosh include a full megabyte of RAM (expandable to four megabytes).

Which means you can run the most sophisticated software without running out of memory. And manage larger spreadsheets, documents and databases.

We also doubled the ROM to 128K, doubling the speed of accessing most of your application programs and data files, through the new Hierarchical File System and RAM-caching support.

The Plus also contains a built-in, double-sided, 800K disk drive. This provides twice the capacity of the previous Macintosh and the equivalent of 400 typed pages, or a bulging file drawer.

If that's still not enough, you can always plug in another 800K external drive.

Or you can really go all out and add our new Hard Disk 20.

(Its 20 megabytes are about 10,000 pages worth.)

Just plug in a Macintosh Hard Disk 20 and you can keep all your software, files, worksheets and documents within a moment's notice of your screen.

Add the Apple program Switcher, and you can actually work with several applications at once, moving information from one into another with the greatest of ease.

So you can transfer notes from an outline to a report – or numbers from a data file to a spreadsheet – as fast as you can click your mouse.

AppleCare.

All Apple products come with an automatic 3-month warranty covering all parts and labour.

But this year, Apple introduced a sort of "Warranty Plus" through the AppleCare service programme.

If you fill out and mail to us the registration form enclosed with your equipment, you will receive nine extra months' cover on top of the normal three.

Macintosh Plus also features a new SCSI connection port (dubbed "Scuzzy" in typical fashion by the development team).

SCSI stands for Small Computer Systems Interface and it's an industry standard.

We've virtually opened up the architecture. But what we've really done, of course, is open up a whole new world of possibilities.

The Scuzzy port let's you daisy-chain up to seven high-performance (and often low-priced) peripherals like hard disks, file servers and tape backups from all sorts of third parties.

Given all this power, it made sense to team it with equally impressive printers.

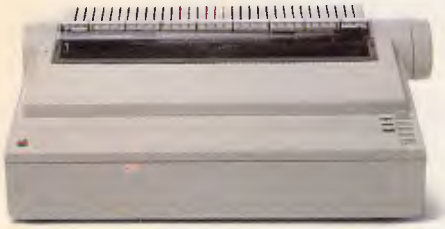
The new LaserWriter Plus is just such, producing documents with text and graphics of publishing quality.

everything except complications.

And it maintains this fidelity on copy paper, letterhead, labels, envelopes or overhead transparencies.

LaserWriter Plus has 35 different typefaces built in, a choice that would embarrass your local printer (and his invoices).

But if you don't need publication-quality printing, you can have near letter-quality by teaming up your Macintosh with the ImageWriter II.



It prints in three different modes: high-quality, standard and draft. And churns it out at speeds of up to 2½ pages per minute.

You can feed in single sheets automatically with the optional SheetFeeder.

And print up to seven colours using appropriate software.

ImageWriter II can also be shared with other Macintosh users via AppleTalk.

But this Macintosh isn't called Plus for nothing. You can just add and add.

Items like an AppleTalk Personal Network.

It's the most flexible, low-cost, easy-to-set-up, easy-to-use network around.

It'll connect up an office full of Macintoshes, LaserWriters, ImageWriters and file and disk servers – 32 devices in all.

Using an electronic mail package, you can send messages to any Macintosh screen on the network.

Or with EtherMac software you can share information with other computers. (Our computer is so friendly it'll even talk to IBMs.)

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If you already own a Macintosh, there's another plus.

You can upgrade your machine to the new one megabyte. Ask your dealer for upgrade details.

You can also upgrade your LaserWriter to become a LaserWriter Plus.

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You helped design it.

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For an authorised Apple dealer near you outside Sydney, you call toll-free (008) 22 1555 or Sydney 908 9088. AP 219/Palace

Apple

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CONTENTS

Volume 7, Number 7, July 1986

REGULARS

FEATURES

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BENCHTESTS & REVIEWS

Martin Banks discovers there's hidden depths to all those computer advertisements.

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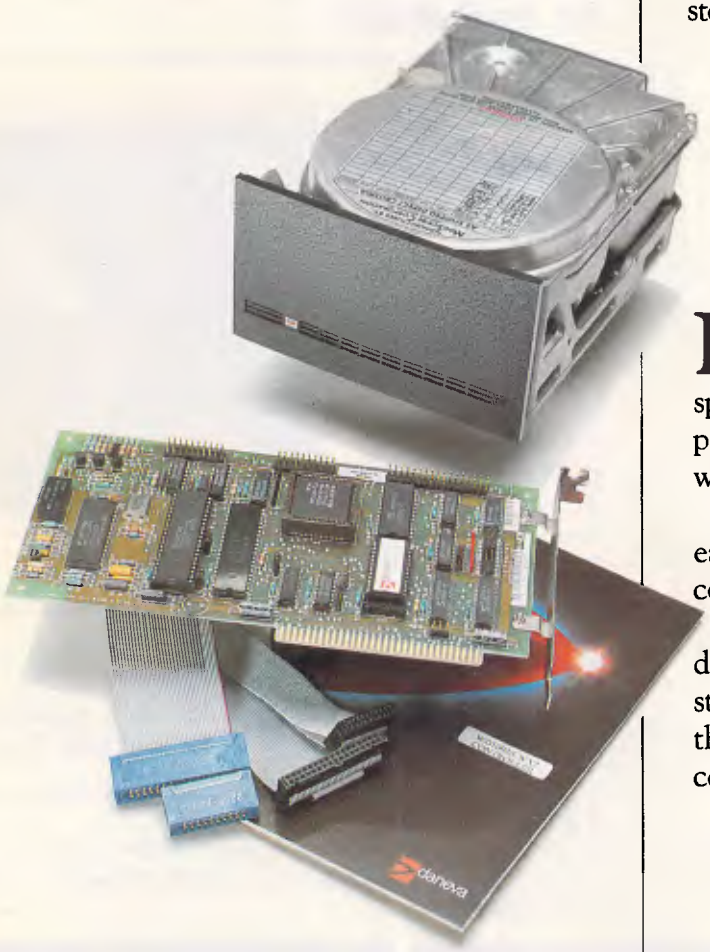
PERFORMANCE Linear voice coil technology yields a 28msec. average access time. That's about 4 times faster than 10 and 20 MByte drives.

BACK UP Support when you need it. Professional assistance from the industry's most competent team.

DANEVA We're dedicated to the science of data storage and management.



Powerful PC software like Lotus 1 2 3 [1], dBase III[2] and Symphony[1] gobbles up disk space at an incredible rate. That's why Daneva packages high performance hard disk drive kits with capacities up to 85MBytes.

Daneva kits are complete, system proven and easily installed ... no fiddling around with complex set up procedures and cryptic manuals.

That's only half the story. Daneva is developing a solid reputation for excellence in storage system hardware and software support for the whole range of IBM PC/XT, AT®[3] and their compatibles.

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[2] dBase III is the trade mark of Ashton Tate.

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DMP 003

Although secrecy still surrounds the specifications of the Amstrad and Apricot IBM-compatibles, Guy Kewney hazards a guess at what we can expect. He presents this month's news round-up.

Something's cooking

Both Amstrad and Apricot are releasing their IBM-compatible machines about three months later than I had thought — in September, rather than June.

In the case of Apricot, the machine is the Xen, with an IBM-compatible BIOS and properly IBM-compatible disks — and I bet you thought, like me, that Apricot already had diskettes that were compatible with IBM's brand-new 3½in Convertible.

In the case of Amstrad, secrecy has not lifted one whit since we last printed rumours. However, we are now sure that the spec will include:

- an Intel 8086, running noticeably faster than IBM's 8088, and, therefore, making a very much faster machine — up to Olivetti M24 speed.
- Digital Research's GEM with a mouse, and a version of MS-DOS, but not Microsoft Windows.
- standard 5¼in diskettes (no, I don't yet know, for sure, how many, but I think two).
- either colour or monochrome screens included (options) in the two basic models, but no printer.
- a proper IBM-compatible bus available, but not necessarily included as standard.

Amstrad is selling its cheap add-on printer in a version that does IBM graphics and characters, which means (to me) that the Amstrad PC won't include a printer. But the people who should know say that it won't anyway, because that would steal the PCW's market. I'm not convinced.

The price? Well, nobody knows for sure, but what little leakage there has been from Amstrad suggests that it will be higher than the $1700 I was led to expect.

From that leakage, I deduce that it will in fact be slightly *lower* than $1700, and that the price is being 'talked up' to make the PC sound better when it arrives.

When will it arrive? Well, assuming it is launched, as expected, in September in the UK, it'll probably be here in time to become a Christmas present.

So much for Amstrad.

Apricot's delay is caused, very simply, by the fact that the Xen has been selling in its home country far better than it deserves to.

The multi-user Xen has tapped a market that looks pretty lucrative — and so have ordinary Xens — and the Xen CD (cut-down) 512k version is only just out.

So, politically, there is nothing to gain by killing off those machines by releasing a truly IBM-compatible machine — yet. And there is everything to gain, politically, because dealers who sell the current machines are not going to take kindly to the suggestion that they have to carry on buying what they have already ordered, when the new one is available.

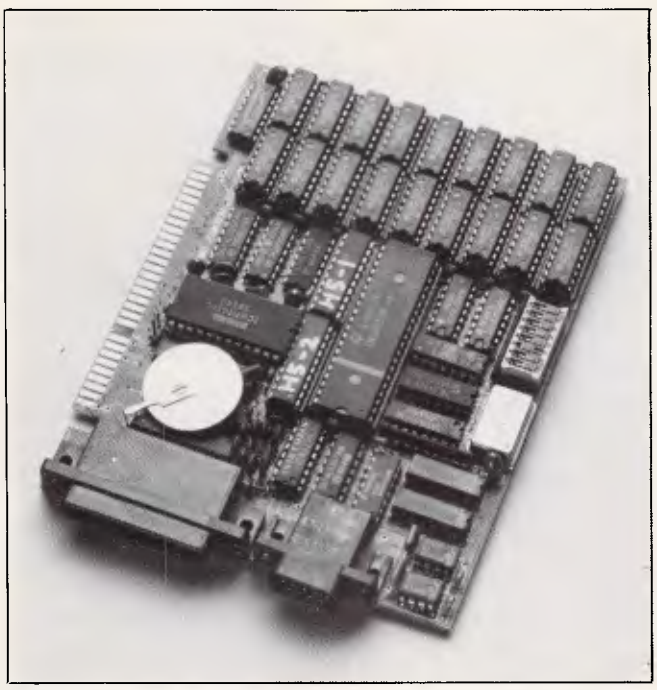
There is also the embarrassing theory (my source is authoritative, but two people I have never spoken to were fired when we revealed the Xen in advance, so they will remain secret this time) that the Apricot disk directory is wrong.

A year ago, when it began to look likely that IBM would, at least, make the move to 3½in disks, Apricot was cock-a-hoop. 'We were there first,' the company crowed.

It seems that somebody inside Apricot decided that they would 'improve' on DOS directories, and as a result, they still aren't there.

In the next three months, Apricot is likely (according to this source) to quietly change the version of the operating system, for one that more closely resembles IBM's.

Guy Kewney



This 'short card' for IBM PCs and compatibles sports 512k of RAM, a parallel and serial port and clock/calendar. It comes with software for print spooling, RAM disk and disk caching. And it's Australian designed and built.

All this costs $685. Call Hypertec on (02) 819 7222 for information on who's retailing it.

The Pawn

I like The Pawn, because when you type in something like: 'Ask the dragon whether ontological poof of

God's existence is a pre-requisite', it says (like any other adventure): 'I don't understand poof' — but you don't have to retype the whole sentence. Instead, you just hit Escape and edit the 'proof'.

No, I suppose that won't do as an adventure game review.

Professional adventure game reviewers must have infinite wisdom or infinite patience. The rest of us, when given a new adventure game like The Pawn, have to cheat — which means we can tell you what the game is about, but not, of course, what it is like.

Except that this game is rather different from many.

I must say that it grew on me, where most adventures wear thin, because it develops in unpredictable ways.

Here is a typical conversation between two players of the game:

'How do you open that wretched safe?'

'Oh, that's simple. You use the key you find near the passage.'

'There is no key there.'

'Oh, yes, there is; in the niche.'

'It's damn well-hidden, that's all I can say.'

'Not at all — you just get it, and there you are. Then you wait for the adventurer to come by, and . . .'

'But the adventurer is fighting the snowman! And he's opened the . . .

'Ridiculous! He can't do that, because then he'd save the princess, and you have to do that yourself.'

In most adventures, there is a set order of doing things. Get the scrolls, then read the spell, and you can open the casket. Try and open the casket without the scrolls, and you will merely fail.

In The Pawn, if you don't get the scrolls, somebody else will. If you don't eat the hamster, you'll possibly never be able to free the tiger; but at the same time, the snowball won't be needed in hell. (I'm inventing things and possibilities, so as not to spoil the game.)

Having decided that you took too long to get a key from one side of the adventure to the other, you go back and replay it, leaving out one or two distractions. This time you get the key, and find that there's nothing inside the room! And it dawns on you, after two or three goes, that there never will be. Something you did has prevented somebody else getting there, and you've got points for doing something else after all.

The Pawn was produced by Anita Sinclair, an earnest young programmer with a sense of destiny, and a conviction that adventures aren't really as important as the parsers that you use to understand the people who play them.

I nearly agree. The trouble is, the parser for The Pawn is so good, it's almost useless.

Where normal adventures have to be told 'get key; look key; look tumblers; look chip; in lock', this one can cope with the far more normal English-like 'Get the key from the desk, look at it and examine the tumblers, then examine the chip and put it in the lock.' (That's a phoney sentence, so don't try it in The Pawn. No chips.)

But if a parser can cope with complexities like: 'Put the key in the jeans on the stump in the pouch,' and even worse tangles of grammar, then you don't expect it to be stymied by: 'Ask trader what the jewel is worth' (you have to say 'what the jewel costs'). Of course, there is a limit to any parser. As with any program, if the programmer thought of it, it can cope. If he/she didn't, it can't.

But for a lot of the puzzles in this game, correct phrasing is vital; for others, it doesn't matter a damn. And I find this a distraction, oddly enough, from the puzzles themselves.

My theology says that Sinclair is quite right up to a point. If you're in a dark room, and you say 'Get all', nothing should happen because the program should be smart enough to know that you can't see the objects. And it certainly should not (as with one Level 9 game) give the whole game away by saying: 'But you can't see the Allosaurus!'

But for me, 'examine fountain' and 'look in fountain' are equivalent, and with a clever parser like The Pawn's, you assume that it understands what you mean. You get used to it, once you crack it, and it's just perfectionism, I suppose, to grumble.

On the Atari ST there's an extra problem, in that The Pawn has been written as if for the Commodore Amiga, and has then been adapted for the Atari. The result is that several things that the Amiga does automatically take forever on the ST, and use up valuable memory — Sinclair has had to abandon several nice features as a result.

I hope they re-appear on the Amiga. I might enjoy playing The Pawn again — only this time, I might try to rescue the princess.

Guy Kewney

New chips to boost ST sales?

Atari's ST is about to get yet another boost with the launch of the famous 'blit chip' and a matching sound chip, which, we all hope, will make the ST directly comparable with the Amiga.

At the same time, Commodore is planning to announce its 1 Mbyte Amiga, around the same time that Atari launches its blit-based machine – and this time, the Amiga blitter will be able to reach parts of memory that it can't on the original model.

The blit chip is a kind of 'personal assistant' to the main processor, handling the fast data shifts that are necessary to produce animated graphics, without requiring the processor to spend time working out which dots are going to be red, green or blue.

The good news is that the blit chip is due for a September release: the (possibly) bad news is that it won't be available for current ST models.

A totally new model with 2Mbytes of memory and the add-in chips, plus one or two other improvements (possibly a hard disk version, too) will be presented to the world in September. It will be on sale some time thereafter, and don't ask me how soon thereafter, because there is no way of knowing.

This new model is the only machine with the blit chip currently planned, until bigger and better (such as 4Mbyte) designs are released. Current machines are not affected.

For some people, the news is good. It means they can rely on the current specifications staying constant.

The rumour of the blit chip was started by programmers, in the know, around Christmas 1985. Subsequently, senior engineers at Atari began giving details of the chip, and included the news that it would not be available in the 520ST, but would be available in the 1040ST as an upgrade.

That turns out not to be true.

You will hear from 'authorities' who 'know about Atari' that the current 1040ST has two empty chip sockets ready for the blit chip and its sister, the sound processor chip.

It doesn't. There are no empty sockets in the 1040.

You will also read, in some places, about the wonderful plug-on box which will allow ST users to upgrade to the blit and sound chip.

This will not be possible.

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The good news, however, is that as you can't upgrade today's ST boxes to blitter spec, you don't have to worry about software for the 520 and 1040 models coming out in two versions, or about making a 520 bought today work with a 520 bought for Christmas this year. They should stay the same. The bad news, obviously, is that many people quite possibly thought they could upgrade, and they can't.

At this point, I'd really like to say how many people are likely to be upset by the news, but I can't, because controversy rages among us industry observers (journalists) about how many STs have been sold.

My own information comes from sources which should be accurate — people who are selling software to ST and Amiga users.

Some of these people get royalties on the sales of machines, and these royalties show that, despite the non-existence of the Amiga in Europe up until June, it is not very far behind the Atari ST in terms of the total number sold.

The numbers are very, very approximate. Making guesses about sales after the last royalty figures, one has to assume that Atari's American sales have been hurt by the company's decision to go mail order with the 260. And I have to report sources saying that the Amiga's big US price cut (down to $700) in May was very good for sales.

Mixing all that together with a lot of other guesswork, it looks as if neither company has hit 150,000 sales, yet.

Guy Kewney

Plug-in problems

Do not assume, when using a business PC or a clone, that every message it gives about errors is correct. In particular, don't believe it when it says your latest plug-in, multi-purpose card, including modem, doesn't work. It probably does.

The problem seems to be software, most of the time.

There's a fundamental difference between the typical PC and the typical AT: the AT has four more DMA channels, and more complex interrupts. The result is that you have to be careful with plug-in cards — especially plug-in disk cards.

The problem is often one of timing, of course, with the AT machines going very much faster than the PCs, and peripherals designed for the PCs just getting confused.

You also have to worry about how many hard disk controllers there are in your system, because these devices use direct memory access, and interrupts, and can conflict with each other.

Strange things happen when these conflicts arise.

Adding-in memory cards, for example, can be a hazard, because IBM-family machines can have 640k. You can't create 640k from 256-kbit chips, so you have to go for 512k, or 768k. Or you can plug in 512k's worth of 256k chips, and 128k's worth of 64-kbit chips — but nobody bothers these days.

Plug in a memory extension card (it may not look like memory extension, and you may think it's just a network controller, or a serial port and a clock) that uses the same spare 128k, and you have two chips responding to the same addresses. Chaos.

People report strange symptoms when they buy their own memory chips to plug into empty memory sockets.

One simple fact is that these memory chips are supposed to keep their data for two milliseconds without electronic refresh. In fact, most of them can keep data for two seconds!

Why is that a problem? Because some software people know they can rely on memory even if they starve it of refresh, and so they can do things much faster. Then you plug in chips which meet the official spec, and the software expects them to exceed it, and the system falls down.

There isn't a lot you can do without sophisticated technical help, except take the board back to the shop and say: 'It may not be faulty, but it doesn't work in my system, and I want a different one, please.'

Guy Kewney

Coopers to the rescue

If your computer system has gone down through "fire, flood, power outage, bombings, industrial disputation, water damage, lightning strikes or malicious damage" you're a potential customer of a new service being offered by Coopers & Lybrand.

Disaster Plan/80 is a disaster recovery planning project designed by Bob Santis, President of EDP Security Inc of Boston. He is currently in Australia to launch Coopers' Australian version of the system. More details are available from Paul Okkerse on (02) 239 7846.

AI key to software growth

The Yankee Group's latest report into the PC software market claims sales of word processing and spreadsheet packages have peaked and further growth will have to be stimulated by the use of artificial intelligence concepts to improve user interfaces and program performance, and the need for multi-user versions to operate in LANs . . . AI may be just the spark to ignite interest among software users in new technology.

Currently, AI has migrated to the desktop computer in three forms: natural language, query optimisation and expert systems. The Yankee Group believes expert system technology remains too limited, even on large systems, to offer real utility to vertical or horizontal markets in the desktop computer business community.

"The more likely short-term role for AI in desktop computer-based business software is to simplify the person/machine interface via natural language front ends or improve the software's performance transparently to the user via such techniques as heuristic query optimization."

Doing the add-on shuffle

There have been winners and losers in the recent shuffle of distributorships of add-ons for PCs. Imagineering (a winner) started the ball rolling when it took the AST range from Sourceware (a loser). Apparently, as part of the deal to entice AST away from Sourceware, Imagineering had to dispose of the distributorship of competing products. So companies as well known as Persyst, Intel and Hercules momentarily lacked Australian distributors; but then Tech Pacific (a winner) stepped in and picked up a basket of products. Says Jim Kennedy of Tech Pacific: "It was a cruel blow to Sourceware, but obviously we're not complaining at being a winner in this shuffle."

Some good news for customers is that Kennedy is hoping to chop $420 off the price of monochrome Hercules cards in the near future; and he's planning to not only knock 20-30% off the Intel Above Board but also offer an 8087 co-processor free of charge to

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purchasers of the memory expansion unit.

Briefs

Visionhire has decided to make Apple IIc and Macintosh computers available for long and short term rental. According to the firm's MD, David Hall: "The rental option opened an entire new market for VCR and colour TV, and we expect it will do the same for computers."

In a separate announcement Visionhire has also announced it has been appointed "principal national corporate dealer" for Commodore's Amiga. The Amiga will also be available for rental, as well as purchase, from Visionhire. . . . Tech Pacific has announced a 20Mb version of its Hardcard, and at the same time heavily reduced the price of its existing 10Mb unit to $1314. The 20Mb Hardcard will sell for $2024 . . . A simple plug-in processor chip has been released by NEC, to make all machines with an 8088 go faster.

The chip has been on the market for some months now and is supposedly a simple plug-in duplicate for the Intel 8088, but with lots of internal functions speeded up enormously.

Do not throw away your 8088 chip, if you perform this upgrade; most of your software will be unaffected, but by no means all of it.

From the *Victor/Sirius File*, a specialist newsletter, comes the news that some of the fundamentally essential programs for copying and formatting diskettes need alteration, if you are using that chip. The newsletter has published a fix for the Sirius version of DISKCOPY, but don't try this on an IBM-type processor.

'86 PC Awards

The winners of the '86 PC Awards were announced at the Seventh *Australian Personal Computer* Show held at the Exhibition Buildings in Melbourne last month.

Presenting the Awards was Regis McKenna, international marketing consultant and author of 'The Regis Touch'.

Products were submitted in eight categories: Business Hardware (Desktop PC), Business Hardware (Lapheld PC), Business Peripherals, Business Software, Business Documentation, Education Hardware, Education Software and Innovative Product of the Year.

Hewlett-Packard's Vectra came out on top in the Business Hardware (Desktop PC) category. Close contenders included machines such as the IBM PC/AT and the Sperry IT.

The Vectra won in the final analysis because the system offered added considerations (in addition to the basic criteria for this category), which were high-resolution screen, keyboard responsiveness and operating speed. The IBM PC/AT and the Sperry IT were very close in second place.

The winner of the second category, Business Hardware (Lapheld PC), was the Zenith Z171 from Anitech. The Zenith was chosen because it comes standard with dual 51/4in floppy disk drives and a high-resolution legible screen. It has compatibility with all MS-DOS software and a full size keyboard of high quality construction.

Apple's Laserwriter Plus took out the Award for category three, Business Peripherals, because of its high quality image output and general operating features. The Laserwriter was pitted against products such as the Mountain Drivecard and the Manager Mouse.

The Award for category four, Business Software, went to Commercial Business Applications, CBA, from Intelligence Australia. CBA was chosen for its broad parameter based structure in

enabling flexibility and a general applicability for business users. Other software in this category included dBase III Plus, Super Project Plus and Pagemaker.

A very broad range of documentation was entered into category five (Business Documentation), which ranged from MS-DOS manuals through to application software manuals. The winner was the Breeze Point-of-Sale documentation from Breeze Software. The judges felt the documentation employed a user-friendly approach combined with a logical and coherent layout.

Category six, Education Hardware, was awarded to Apple for its Unidisk 3.5. The winning feature is its useful and practical contribution to the education market — particularly its resource sharing capability.

The winner of category seven (Education Software), was Newsroom from Dataflow. Newsroom was chosen for its high educational value as it enables users to use text and graphics and produce hard copies. Newsroom covers a very broad area of history, english, science and mathematics and caters for a wide age group.

Category eight was the readers' choice for the Innovative Product of the Year. Pagemaker from SCA was chosen because it represents a pioneering approach to small and large businesses alike in the world of desktop publishing.

'86 PC Award winners from left to right: Garry Landers of Breeze Software; Keith Watson from Hewlett-Packard; Inge Fuglestved from Apple Australia; Chris Cleary of Intelligence Australia; Peter Dawson from Anitech; Arnold Roth from Software Corporation of Australia; and Dr Jeffrey Tobias from Dataflow.

Regis McKenna delivering his message.

Next month's issue of *APC* will be accompanied by a free guide to PC communications. It'll cover modems, software, networking, dial-up databases, micro-to-mainframe links and what's in-store in the future.

Don't miss out: get your copy as soon as it goes on sale in the first week of August.

END

Curtains down!

After the rave reviews we gave last year's PC86 Show in Melbourne, and not withstanding any bias we may have in this matter, it would be unfair for us not to say that this year's event was even more spectacular. Combined with an office automation and communications show and held in the Royal Exhibition Building, the Seventh Australian Personal Computer Show attracted more visitors, more exhibitors and more new products.


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1 Everyone wants to be IBM compatible — even the 6502-based BBC. Gametronics was showing off this card (which we've not had a chance to examine yet) designed to allow a range of IBM PC-compatible software run on the Beeb.

2 Pagemaker, winner of the '86 PC Readers' Award, shown doing its stuff.

3 The important bit here is the box to the right of the screen. It's Amiga's Sidecar; and it allows programs written for IBM PCs and compatibles to run on the 68000-based Commodore Amiga. (See review elsewere in this issue).

4 This large flat keyboard is just one of a number of devices displayed by MicroPower which is intended to assist the handicapped in using PCs. It is composed of a large matrix of sensitive 'pads' on which is placed a paper template and, if desired (and shown here), a plastic guiding overlay. The 'pads' are programmable so that one 'pad' could represent a letter of the alphabet or an entire series of commands. The keyboard is connected to a card within an Apple computer which operates transparently to any application software.

5 This is a laser disk WORM drive. It's unusual because it can not only read but also write (once) to its 12in optical disk. Its capacity is around two gigabytes; unfortunately its price is well beyond the average user at over $20,000. Call Pulsar Electronics for details.

6 When Imagineering's MD, Jodee Rich, decided to pick up the Australian distributorship of AST products, this man, Jim Kennedy, picked-up what Jodee had to leave behind — including the Hercules and Intel range. Jim is intending to knock considerable amounts off Imagineering's old prices for these products. Call Jim's company, Tech Pacific on (03) 690 9055 for details. (Incidentally, Jim is shown here with his Hardcard — reviewed last issue — which is now available with either 10 or 20Mb capacity).

7 Atari was crowing at the Show about having some business software actually up and running on its 1040ST. A New Zealand package, Cashlink, is shown here on the Mobex stand. What Atari is particularly pleased about, though, is that the Business Operating System (BOS) has been ported to the Atari. BOS is very popular in the UK where there's a large amount of business software for it. So it's likely Atari will soon have a large range of packages to throw at the IBM PC-compatible opposition.

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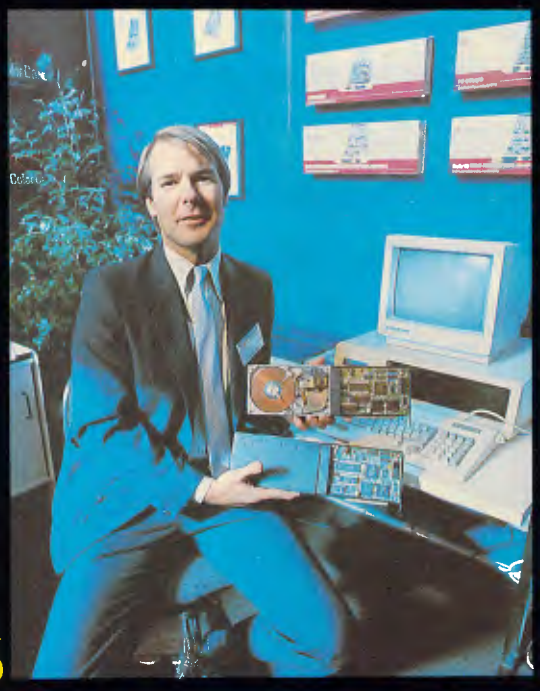

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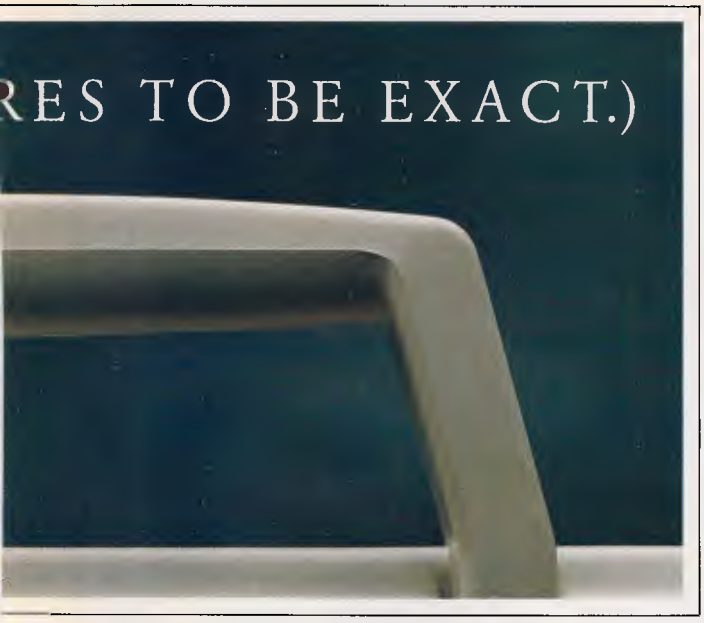

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C&MA MBS 0023

Illustration by Paula & Peter Knock

Building structures

In the first part of a six-part series on the creation of programs and programming methods, Mike James examines the role of data structures in determining algorithms.

A revolution is taking place in programming methods and programming languages, and I have no doubt that it will eventually make itself felt by every programmer. This revolution is mainly driven by the desire to make programming more precise and mathematical and is typified by the new languages based on logic (such as Prolog).

The desire to make programming more like mathematics goes back a long way. Many earlier programming methods — structured programming and modular programming in particular — certainly help with the task of constructing a good program with minimum effort. The success of these programming methods and the languages which they have spawned (for example, Pascal) has continued to focus attention on the part of programming which is usually referred to as *coding* — that is, given that you know exactly what a program should do, most programming methods are designed to help you realise your ideas as a bug-free program as easily as possible.

What programming methods have ignored completely is the process which precedes the stage of coding — that is, getting the ideas for the program in the first place. This important area has been ignored because it's difficult and not as neat and clear-cut as the coding stage of programming. However, there's much more that can be learned about program creation than is generally realised. In this series, I'll be sharing some of the insights I have gained by my own programming experiences and talking to programmers, both beginners and advanced, about the way they go about creating a program.

As the initial conception of a program is mostly independent of which language you later use to code the program, this series is relevant no matter which languages you are familiar with. As Basic is such a universally well-known language, it will be used to code the example programs and as an aid to describing the problems of program design.

Before launching into the subject of program creation, it's worth summarising briefly the currently accepted state of programming methodology.

Programming methods

Perhaps the first step on the road to constructing better programs was the introduction of high-level languages such as Fortran and Basic. Although machine code and assembly language gives a programmer more freedom in the way the machine is used, they also give the programmer more scope for making complex and subtle errors in coding. For example, in machine code you can use any area of memory to store data, and in any format, but in a high-level language, all you can do is create variables, and the language implementation decides where and how the data will be stored. Nearly all improvements in programming are about trading off some freedom of choice for simplicity and clarity.

The advent of high-level languages solved many of the problems of programming data storage, but early high-level languages contained the same types of control commands that were found in assembly language. In other words, the early high-level languages (including Basic) gave the programmer statements to test conditions and transfer control to another part of the program. For example, in most assembly languages, if you want to skip a section of the program if a value is zero, you would use something like:

```
    TEST VALUE
    JUMP SKIP
    ...
    section of program to skip
    ...
SKIP remainder of program
```

which is almost identical to the Basic version:

```
    IF VALUE=0 THEN GOTO 100
    ...
    section of program to skip
    ...
100 remainder of program
```

The trouble with this type of control is that it allows the programmer the freedom to use the GOTO statement (or whatever the language calls its unconditional transfer of control statement) to transfer control to any point in a program without any regard for the effect that this might have on the program's clarity. The GOTO statement allows a programmer to tie a program into knots, making it impossible to follow; a program which is impossible to follow is sure to contain bugs.

The first reaction to the above problem was the invention of programming languages such as Pascal which removed the need for the GOTO statement and then placed a complete ban on its use. This restriction on the use of the GOTO statement is generally referred to as 'structured programming'. Many programmers now feel that to think of structured programming as just GOTO-less programming is a little naive. It's possible to write well-structured programs using Basic, assembler or any language, with or without the use of the GOTO statement. Structured programming can be much better thought of as a method of producing programs which have a clear and simple flow of control, by restricting the use of the GOTO statement to the selection between alternatives and the formation of loops.

The final great step forward in programming methods takes us back to data storage. Basic programmers have become used to the idea that when a variable is defined, its accessible from any point in a program: that is, if you use a variable called TEMP in a subroutine, it will be shared with any other subroutine using a variable called TEMP.

A variable which is accessible from any part of a program is called a 'global' variable, and it's generally agreed that global variables cause bugs. The trouble is that if two or more subroutines use the same variable name for a variable which does a different job in each subroutine, there will be unwanted and unexpected interactions between those subroutines.

The solution to this problem is the

introduction of 'local' variables — that is, variables which exist only within a specific part of a program, usually within a single subroutine. The existence of local variables allows a program to be broken down into individual subroutines, or modules, which interact only through the parameters that are passed between them. This idea is called 'modular' programming and has been incorporated into some of the more advanced versions of Basic as well as being standard in most other languages. Even in standard Basic, it's possible to use variable naming systems to create the same effect as local variables, and so to use modular programming.

The current state of programming can best be characterised by the use of high-level applications-orientated languages and structured modular programming. Programs produced in this way tend to be easy to understand and consequently bug-free.

Algorithms expressed

The great success of structured modular programming has encouraged computer scientists to concentrate on improving the clarity of a program's text. The principle is that the text of a program is an expression of an idea of how the program should work (its algorithm), and this expression should be as clear as possible in order that other programmers can understand the algorithm, and in order that the program can be checked for accuracy. If you find it difficult to see the difference between a program and an algorithm, think of a number of programs, each one written in a different computer language, but all doing the same thing. Each program is different, but they are all expressions of the same algorithm.

Currently, emphasis is being placed on how to best express an algorithm, and the rather more serious question of where the algorithm comes from in the first place has been more or less ignored. When you know the algorithm, programming is a matter of coding, and this is comparatively easy. We need to take some time to study the way algorithms are created by programmers before they are expressed as finished or partially finished program texts.

Studying programs

The first problem with trying to investigate the way that programmers create algorithms is that algorithms don't exist unless they are expressed in a language. For example, if I ask you to write a program that will find the average of a list of numbers, the algorithm exists in your head as a sequence of steps even before you code the program. Perhaps you think something along the lines of:

read-in each number in turn
add each number to a 'running sum'
count each number
at the end of the list divide the runnning sum by the count

This is already a primitive program. It's the expression of the algorithm in English, and from this point of view coding can be seen as a process of translation rather than creation. However, if you examine this expression of the proposed algorithm for finding the average of a list of numbers, you'll find that it's far from crude. The statement 'read-in each number in turn' implies some kind of loop, and 'at the end of the list . . .' implies that this loop comes to an end when there are no more numbers to be read. The statement 'add each number to a *running sum* implies that the programmer has come across the basic mechanism of the running sum, and knows what it is and how useful it is. (A running sum is an expression of the form SUM=SUM+VALUE found inside a loop). Also, something which is not obvious is that the algorithm requires that the running sum is initialised to zero before the first iteration of the loop.

Even this English description of an algorithm is already a program in the sense that it's an expression of what should be done to work out an average. It's a vague expression of an algorithm which will be made more precise and explicit during coding. It's clearly impossible to discuss an algorithm without using some expression of it, which makes it difficult to get at the essential details of the algorithm. For example, how has it become clear that the working out of the average of a list of numbers needs a loop? Once you know that a loop is involved, you can start asking more specific questions such as exactly what happens in the loop and when should the loop come to an end? What is mysterious is how any programmer ever knows that a loop is involved at all?

Obvious loops

If you are having difficulty in seeing what all the fuss is about — finding the average of a list of numbers obviously involves a loop — let me state that I have given this problem to a great many beginners without any hints, and watched them make no progress at all. There is nothing naturally *loopy* about forming an average from a list of numbers. For example, if I ask you to add 3, 5 and 10, you will think of it as 3+5+10 which is a single arithmetic expression, not a loop. If you use a spreadsheet, you will find that you can add up lists of numbers by using a single function — something like SUM (A1:A15) which is, once again, not a loop. If you have the kind of programmer's mind which can cope with recursion, you can total a list of numbers using a recursive function in the form of SUM(N)=SUM(N-1)+A(N) and SUM (1)=A(1) which is not a loop.

My best guess, judging by what beginners try to do, is that non-programmers tend to see forming a sum of a list of numbers as a single piece of arithmetic such as A+B+C. Only programmers skilled in the art of using loops see that forming a sum of a list of numbers is a repetitive process, and even then it can sometimes be difficult to see exactly what it is that is to be repeated. For example, try this simple

Inside information

Two standard things happen inside loops — running sums or running products. In general, most programmers meet the concept of a running sum early in their education. For example, to add up the first N whole numbers, you would use a running sum as in:

```
SUM=0
FOR I=1 TO N
SUM=SUM+I
NEXT I
```

Running products are far less common, but are just as easy once you have seen an example. To multiply the first N whole numbers, you would use a running product as in:

```
PROD1
FOR I=1 TO N
PROD=PROD*I
NEXT I
```

The detail which catches out most beginners is that SUM has to be set to zero before the loop, but PROD has to be set to one — why? Apart from the running sum and the running product type of operation, not much else happens inside loops!

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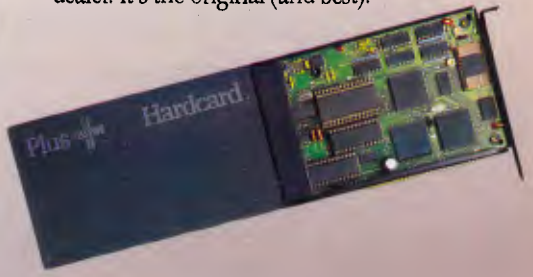

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problem: write a Basic program which will form the product of the first N whole numbers: that is, if N is 5, work out 1X2X3X4X5. By comparing this problem with the problem of forming the sum of a list of numbers, you can see that it should be possible to use a loop, but what takes the place of the running sum? (See 'Inside information' for the solution.)

Data neglect

While there are no rules which state that the sum of a list of numbers has to be worked out using a loop, nearly every programmer working in a standard high-level language would recognise that this is the simplest and best way. The reason for this comes from a consideration of something which is not made clear in the statement of the problem — what is a *list* of numbers?

A programmer will naturally think of a list of numbers as a sequence of numbers entered one at a time in response to an INPUT statement. A non-programmer will think of a list of numbers as something static — more like a list written on a piece of paper. This is a crucial difference, as the idea of using a loop only arises when you think of each number being read in turn. It's not so much that a loop is an obvious part of the process of forming a sum, but rather that it's suggested by the form of the data.

This is a surprising observation. It is generally assumed that the major part of writing a program is concerned with finding out *how* to do something, but the above example shows that the way in which you think about the data is a first step towards constructing an algorithm.

It has long been recognised that programs are composed of two related elements: data, and the process to which the data is subject. A program is like any recipe for action — it tells the computer what to do and what to do it to. Nearly all programming methods to date have concentrated on the 'what to do' part of programming, and have more or less ignored the role of data in determining the algorithm. After watching beginners learn to program and by examining the way in which I generate algorithms internally for consideration, I believe that the way we think of data is a key factor in the creation of algorithms. Of course there are other factors, but these are much simpler and are concerned with our knowledge of the problem and of the programming language being used.

Creative challenge

The way in which you think about the data you are working with influences the algorithm you will create for any given task. With this in mind, write a program which will draw a histogram (composed of asterisks) of values in the range zero to 40 stored in an array D(5). That is, if D(1) contains six, draw six asterisks on the first line; if D(2) contains 10, draw 10 asterisks on the second line, and so on.

First, try the most obvious solution to this problem which involves using a pair of nested loops: one to draw a line of asterisks of a given length; and one to draw such a line for each element of the array. If you think about the data (in its broadest sense) used by this program, it's possible to achieve the same result using only one loop? How?

The answer will be given next month.

Conclusion

Experienced programmers do think differently from beginners. Good programmers certainly make use of the data properties with which they are involved (this is the subject of next month's article), but as well as this, they have a clearer understanding of the process of computation. In particular, they seem to carry around inside their heads clear models for loops and ways of selecting between alternative sections of a program.

When you first learn to program, it's rather like learning to drive a car. You know how to change gear but you still have to think about it, and this leaves little room for any higher-level activity such as thinking about where you are going. Later, changing gear becomes second nature, and you are free to think not only about where you are going, but which route is the best. When the fundamentals of computation — the loop and the select — become second nature, you will be sufficiently competent to solve real programming problems.

END

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Sperry IT

Clone makers, having had their fill of the IBM PC are now rushing to cash-in on AT compatibles. Ian Davies takes a look at Sperry's latest offering, the Sperry IT, with its multi-user software, Mapper.

Sperry is the latest contender to join the AT compatible race with a new machine dubbed the IT. Almost indistinguishable from the IBM beast, Sperry has attempted to go for performance with a dash of individuality.

Following well established AT lines, the IT is a large box, best suited to placement alongside a desk, rather than on it. Sporting the traditional security key and DASD symbology, the IT even manages to weigh more than the real McCoy.

The IT seems to be following the original AT philosophy which was multi-user. However, the bast majority of ATs are being used as fast single user machines, mainly because buyers can either run multi-user under Xenix (and be lacking somewhat in software), or they can have access to all the top end-user type software by running single user under MS-DOS. Sperry, however, seems a little more serious about multi-user than IBM was. Although the IT makes a very adequate fast single user machine, it is somehow easier to imagine it as the mythical departmental processor.

Hardware

In true form, the IT runs an Intel 80286 processor at either 6, 7.15 or 8MHz. The speed is switch selectable, accessed either through a panel on the rear, or by removing the cover and flicking DIP switches, depending on the model you are lucky enough to get. The 6MHz one wait state mode is provided for IBM AT compatibility, the 7.15 no wait state is for maximum performance, and the 8MHz one wait state is a bit of a puzzle. A wait state is simply the number of clock cycles for which the processor must pause when accessing memory. Essentially, running with wait states is either a voluntary speed reduction, or indicates that the memory is too slow for the processor, and thus performance is wasted while waiting for the memory to respond. I can't really imagine anyone running the IT on less than full speed, and while it's nice to see that Sperry can let the 80286 have its head at a full 7.15MHz, this doesn't make it the fastest AT compatible around.

Two levels of IT are supplied by Sperry. The first is considered to be the single user system, and roughly corresponds to the IBM entry level AT, consisting of a single floppy disk drive, 512k RAM and no hard disk. Standard equipment includes a parallel printer adaptor (nicely compatible with the IBM version of the Centronics interface), two serial adaptors (more on these later), a choice of display and a choice of keyboard. The multi-user configuration adds a 40Mbytes Microscribe full height hard disk and an extra 512k RAM, taking the total to 1Mbyte. This would be the minimal system most users would contemplate.

Sperry's 98 key enhanced keyboard

If there is one feature which characterises this machine, it has to be the number of serial ports. They're everywhere. With two serial ports as standard equipment, extra ports can be added using multi-terminal adaptor cards, each of which sports four serial ports. Up to two of these boards can be installed, thereby providing a maximum of twelve ports. This is where the multi-user angle comes in. The IBM AT can only support three serial ports, thus making the whole multi-user issue somewhat limited. Who wants to go to all the hassle of running Xenix just to have a system which cannot grow past four users? The Sperry, in comparison, has got true growth potential, and possibly makes the whole bother of multi-user worth thinking about.

My only criticism is that all of the serial ports use the alternative RS232 standard of 9 pin D-type sockets. So you can't plug in a modem or comms cables without a 25 pin to 9 pin adaptor. Thinking about it a little more closely, Sperry had a good reason for going the 9 pin route, and it is simply that the physical space taken up by twelve 25 pin sockets would be prohibitive. However, being a dedicated 25-pinner, I feel Sperry could have provided at least one really standard RS232 socket. On the other hand, it might have made things even worse to have two conflicting standards all on the one machine.

More options are available for the keyboard. The preferred choice is the Sperry enhanced keyboard. This departs from the PC/AT convention, providing a separate numeric and cursor pad, function keys across the top (very tricky in Flight Simulator), separate editing keys and delineated regions. The PC keyboard is a standard PC style keyboard with a number of subtle variations. I find that switching between two keyboards with subtle differences is much harder than switching between, say, a VT-220 and a 3270. The third keyboard is the PC/IT, and seems to be just about identical to the IBM AT keyboard.

Three different display adaptors are available: monochrome, medium resolution and high resolution colour. The review machine was supplied with the top of the line and, while it was a very nice display, naturally all of the MS-DOS graphics software could not drive it to its highest resolution. A well known nasty with the IBM AT is the quality of the character font when using a graphics screen. IBM still uses only an 8 x 8 font on its standard adaptor board, which makes the characters very dotty — a strain for lengthy text work. Olivetti, with the M24, managed to maintain graphics compatibility while switching into an 8 x 16 font in text mode, thereby giving the best of both worlds. For a while it looked as though Sperry had managed the same trick. Unfortunately, while the normal text font is significantly better than 8 x 8, certain useful pieces of software, such as Borland's Turbo Pascal, kept switching it back to an 8 x 8 font. Despite this, Sperry certainly managed to achieve graphics compatibility, with Flight Simulator and Jet running well.

Memory options come on 2Mbytes cards. Up to two of these can be installed, adding to the initial 1Mbyte to

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Database management

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- IBM/ANSI standard query language
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- Query history editing
- Multiple verb definition
- Keyword/message translation
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Spreadsheet

- Comprehensive set of functions
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- Integrated business graphics
- Windowing
- Labels
- Row/column titles
- Column width manipulation
- Absolute/relative addressing
- Command saving in text form
- Fast spreadsheet save/recall
- Command line editing
- Separate data/logic
- 1,000 rows x 1,000 columns
- Natural/row/column calculation
- Decision logic
- Output formatting control
- External data capture/output
- Prompted operator data capture
- Optional single key commands
- Interactive integration control
- Embedded database unix cells
- Linked spreadsheets

Graphics

- Business graphics capability from low cost screens
- Bar/line/scatter charts
- Mixed text/data/graphics on screen
- What you see is what you get
- Output on laser/matrix/LQ printers
- Colour supported

Menu system

- Integrate spreadsheet
- Integrate database
- Point and pick option selection
- Pass a filename to a Unix command
- Remark in menu
- Fetch user data for command
- Run a Unix command
- Define a user prompt
- Restructured menu layout
- Multi-columning
- Concatenate options
- Softkeys
- Boxing
- Text lines
- Document folios
- Multi-level menu structure
- Help on any subject

Screen builder

- Compiler syntax checker
- Response mapping
- Comprehensive error checker
- Input validation to order
- Default values
- Form security
- Alpha/numeric/general input classes
- File/directory/executable checking
- Abandon/execute functions
- Individual prompts on fields
- Parameter passing
- Screen appearance definable
- One of a range/type
- Full cursor control and editing
- Over 75 fields possible
- Mandatory input
- Field/form reset
- Scrolling default values
- Limit definition/checking
- Protected fields
- Inter-field comparison
- Multi-paging
- Definable variables
- On-line help and assistance

Calendar management

- Multiple diaries
- Shared diaries
- Private/public diary facilities
- Time scheduling/multiple booking
- Copy/edit/remove facilities
- Alarm/reminder facility
- Alarm suspend/resume
- Monthly/bi-weekly diary views
- User/group alias
- Appointment conflict warning
- Resource diary

Electronic mail

- Inter-user talking
- User aliasing
- Efficient data storage
- Telephone database
- Receipt and mail read verification
- Entry validation
- Multiple machine capability
- Individual letter reference
- Local/shared directories
- Activity logging system
- Page control during read
- User by user configuration
- Help facilities
- Archive incoming mail
- Compatible with Unix mail
- Copy to another user
- Object orientated
- Document attachment option
- Alignment of prompts
- Shows video effects
- Audible indication of mail received
- Forward to another user

Uniplex II Plus is the world's leading integrated office automation system running on the Unix operating system.

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Uniplex II Plus is now available on the IBM PC/AT, Xenix System 5 and the AT & T 3B series of computers

produce a grand total of 5Mbytes.

The floppy drive can either be a 360k PC compatible, or a 1.2Mbyte (96 TPI) AT compatible. The review machine was equipped with the 96 TPI drive, and it worked flawlessly throughout. Like all high density drives, disks which are formatted to 48 TPI may not necessarily be readable on true 48 TPI drives. This is because the 96 TPI drives have half size red/write reads and step half the distance per track. When a diskette is formatted at 48 TPI, the high density drive simply skips twice between each track. This provides the desired track density, but since the head is smaller, leaves an unformatted area between each track. Real 48 TPI drives with larger heads may have trouble reading this.

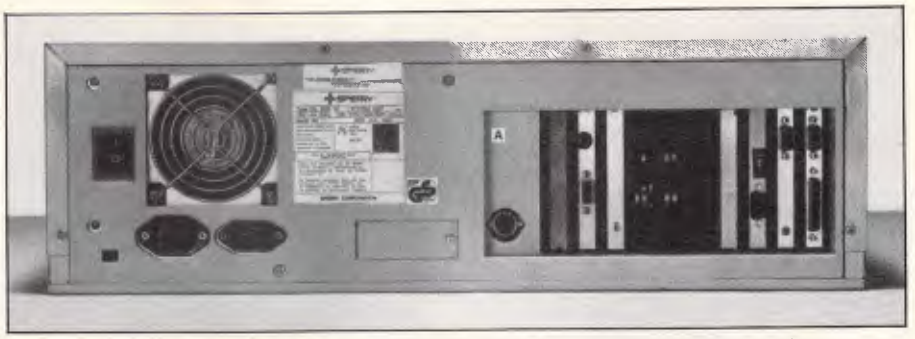
For expansion, eight full size slots are provided, six of which are 16-bit slots, and two of which are 8-bit slots. The IT would seem to have no problem swallowing IBM standard cards, as a Microsoft mouse board was happily living in the review machine. Not all of these slots are completely usable, however. Each of the multi-terminal adaptor cards is double bracketed; in other words, although they only consume one of the actual slots, they occupy two of the back plane holes.

Included as standard is one serial/parallel board. This is also double bracketed, but does not take up more than one slot due to a thoughtful arrangement on the mother board. An additional slot is occupied by the hard and floppy disk controller boards as well as a display adaptor board. This leaves one spare 8-bit slot, and four spare 16-bit slots.

An optional 80287 arithmetic coprocessor can also be installed. Velcroed to the back of the system unit are the batteries for the CMOS clock calendar. One final point I must mention is the multi-coloured LED used for the hard disk indicator. This is real high-tech stuff. The LED glows green when the hard disk is ready but not in use, and red when in use — all through the one LED. It's good to see leading edge technology getting into these boxes one way or another.

One other essential option is the vertical floor stand. This lets you place the IT either under or next to your desk, thus consuming a minimum of space. Based on technology originally pioneered by DEC, the Sperry logo rotates for vertical mounting.

The hard disk seemed quite fast. Unfortunately, Sperry was not able to provide performance figures in time for the review. When the review machine first arrived, the disk had a loud pitched scream whenever operating. With time, this scream reduced to a murmur, but not before alarming one or two visitors with a particularly loud outburst. Presumably not all of the hard disks have this problem, and I am sure Sperry would be quick with a replacement if anyone had the misfortune to actually purchase a screamer.



With two serial ports as standard, extra ports can be added using multi-terminal adaptor cards.

Documentation

The documentation provided with the system is of the same ilk as the IBM stuff. Included with the system are a System Installation Guide, MS-DOS 3.1 Users Guide and Microsoft GWBasic 3.0 Users Guide. A small box of diskettes holds MS-DOS and the diagnostics routines which include a facility to 'park' the heads prior to transportation.

Finally, as far as I could tell, the machine is almost entirely manfuactured by Mitsubishi in Japan.

Application software

If Sperry really wants to pursue the multi-user aspect of the IT, surely what is needed is some decent multi-user software.

Let's not get this confused with multi-tasking software, such as Concurrent PC-DOS and Concurrent CP/M, which allow the one user to run multiple programs at the same time. Similarly, much of the PC software which is called multi-user is in fact LAN based, which means that you need a separate computer for each user, and a cable running to a central machine which controls the database.

"If Sperry really wants to pursue the multi-user aspect of the IT, surely what is needed is some decent multi-user software."

True multi-user means you have one machine — one chunk of memory, one

In perspective

The IT is a rather curious machine. On the one hand, the world really doesn't need yet another AT compatible machine, or if it does, it needs one at a lower price. With the Asian AT compatibles now available for around $5000, one has to wonder if people are going to be prepared to pay over $15000 for much the same thing with a Sperry label on it. Now, if it had an IBM label on it, *that* would be a different story.

On the other hand, the original idea behind the iAPX80286, and therefore the IBM AT, was multi-user. Clearly the AT has not travelled well down the multi-user route, but it is possible that the Sperry IT just might. Particularly when one considers the existing mainframe Sperry Mapper users with a training and application software investment to protect, combined with the strong corporate need for departmental processors.

The 80386 lies just around the corner, and the majority of its stunningly powerful features are aimed predominantly at the multi-user/multi-tasking scenario. Certainly it's hard to take advantage of 64Gb RAM addressability, on-chip demand paging logic for virtual memory and user/supervisor states under MS-DOS. However, with the availability of Xenix and application software such as Mapper with a real attraction for the corporate sector, Sperry may well be paving the way to something more exciting. The 80386 stands to threaten the existing low-end Vax market, but only for multi-user/multi-tasking. Those vendors best positioned for multi-user might be the only ones who can get true mileage out of the 80386.

CPU and a whole heap of RS232 ports on the back into which you can plug dumb (or semi-dumb) terminals. Since MS-DOS does not yet support multiple users, Xenix is the recognised route. However, Sperry has managed to port Mapper, a mainframe based 4GL to the IT and, through it, provide some degree of true multi-user capability.

Personal Mapper fits strangely with the IT. First of all, a portion of the hard disk must be reserved for its use via the FDISK utility. FDISK allows you to partition your hard disk into separate areas which are totally non-accessable to each other, and is usually used when two operating systems must be installed on the one hard disk. The real problem with FDISK, however, is that the areas and their sizes are fixed for all time. To vary the size of the DOS partition, for example, the partition must be completely reformatted after the adjustment. This involves taking a complete copy of the partition to floppy disk or tape, and then reloading. Thus Mapper is not the sort of software you can throw on to a machine at the slightest whim. Indeed, the documentation seems to suggest that it would be normal to allocate most of the disk to Mapper, thereby making a Mapper machine. On the review IT, only 15 of the 40Mbytes were allocated to MS-DOS.

"To ease the transition from mainframe to PC, the keyboard conventions are that of mainframe Sperry terminals."

Personal Mapper also requires the addition of a Mapper board. This device provides a Motorola 68010 processor, several PLAs (programmable logic arrays), a 32MHz crystal which is divided down to probably produce an 8MHz clock, and additional memory. The Mapper board can also be installed in IBM machines, simply by flicking a few switches.

Thus the end effect of installing Personal Mapper is really to have two computers in one.

Naturally, by taking this approach, the multi-user capability is only available within Mapper — you still cannot run multi-user Lotus or Multimate, or any other PC software which is not designed for true multi-user use.

Why port mainframe software to a PC?

Why indeed. Mainframe software is almost always less friendly, less intimate and less easy to use than PC software. It is also usually more powerful — but at what cost in terms of usability? Mainframe software stands out like a sore foot on a PC. It's the stuff that can't scroll sideways in real time; always requires you to keep pressing Enter; makes little use of the extended character set; seems to be caught up in mainframe operating system terminology and has less than ideal performance.

There are really only three reasons why someone might want to run a port of mainframe software on their PC:

Firstly, the software is just so good that it would be unfair to only make it available on the mainframe. This is rarely the case.

Secondly, the power and functionality is required for the job at hand. This has often been the situation in the past, but is becoming less so.

And thirdly, a mainframe already exists and has lots of applications written.

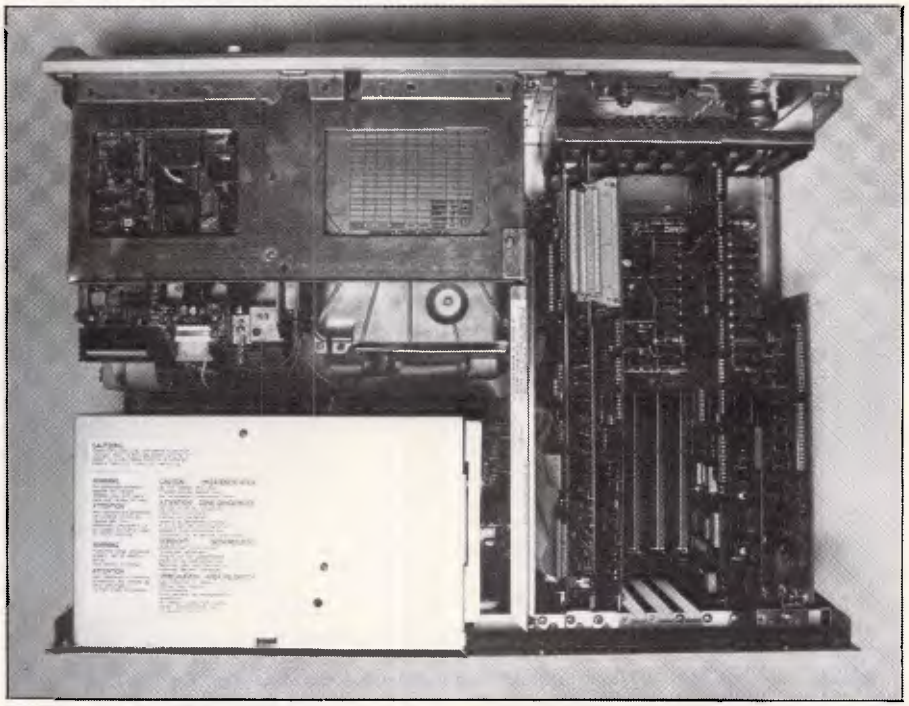
It is the third reason which is the most important. It really only applies to corporate users, but is a very large part of the market. Consider an organisation with a Sperry mainframe running mainframe Mapper. As the user load increases, upgrades are necessary. While additional disks or a few extra megabytes are not terribly expensive, the inevitable processor upgrade certainly is. There are mountains of people trained in the use of Mapper, and dozens of Mapper applications currently being used. To this corporate user, the prospect of shifting a number of those applications onto departmental PCs, without recoding, without retraining, and thereby saving mainframe resources would be something too good to pass up.

Personal Mapper seems to be a full implementation of mainframe Mapper. To ease the transition from mainframe to PC, the keyboard conventions are that of mainframe Sperry terminals. The Scroll lock key becomes the XMIT button, and several others keys are redefined in a similar way. A template provided illustrates the reassignments.

A full description of Mapper is probably not appropriate, as those corporate users who are going to be intensely interested already know all about Mapper, and those non-corporate users are probably not going to be very interested. Nevertheless, Mapper is based around RIDs and RUNs. A RID is a number followed by a letter which identifies a report to be produced. Report specification is rather similar to QBE (Query By Example), with the added ability to store report specifications (using a RID number).

Additionally, programs can be written using a series of cryptic three character commands. These are called Run Control Statements, and are grouped together into RUNs, which are effectively programs. RUNs can be started by name.

Being very mainframe-like, Mapper requires users to log on with a user identification code and access mode. Administrator facilities are provided for the creation and maintenance of users,



For expansion, eight full size slots are provided.

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The Sperry PC/IT outperforms its major competitors in speed, price and expandability. Features include:

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- Intel 80286 microprocessor with switch selectable clock rate, choose 6 MHz, 7.15 MHz or 8 MHz.
- 8 full expansion slots (2 x 8 bit and 6 x 16 bit slots).
- 2 built-in RS 232-C ports plus parallel port.
- 40Mb mass storage option available.
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- 256 colour high-resolution graphics.

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Personal Mapper is supplied with a suite of four boxed manuals, encompassing installation and administration, software reference, getting to know mapper, and RUN designer reference. Clearly each of these manuals is targeted at different types of user. I found them all rather heavy going, full of RIDs and RUNs. For the non-Mapper reader, a better section on terminology and an overview would have been useful.

I found Mapper very difficult to use, but then I am not the real market for something like this. The true Personal Mapper user would take to it like a fish to water, gleefully finding that it's just like the mainframe version.

Prices

Mapper retails for $4250. The basic Sperry PC IT unit comprises of a single floppy with 512k RAM and retails for $6500. A monochrome monitor $443, and a display controller $345. A medium resolution colour monitor costs $1153, and the display controller is $557. A high resolution colour monitor $1931, and a display controller $1158.

An extra 360k drive costs $575, or a 1.2Mbyte drive retails for $775.

A choice of two keyboards: the professional $375 or the standard IT keyboard $312.

A 44Mbyte hard disk system with 512k RAM costs $9650. An extra 512k to make 1Mbyte costs $850. An expansion kit to make 2Mbytes costs $3950. The system is expandable to 5Mbytes.

A 60Mbyte tape back-up unit costs $3996. An extra 44Mbyte hard disk costs $3450. The hard disk controller costs $995.

Technical specifications

Processor:	Intel 80286 running at 6.0, 7.15 or 8MHz
RAM:	512k or 1024k, expandable up to 5Mbytes
Keyboard:	84 key PC style 84 key AT style 98 key Enhanced
Display:	Monochrome Medium resolution colour High resolution colour
I/O:	Centronics parallel, two 9 pin RS232 serial, expandable up to 12
DOS:	MS-DOS 3.1 or Xenix
Disks:	360k or 1.2Mbytes floppy 40Mbytes hard disk
Tape:	Optional internal streaming tape backup unit

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To use the IT as a multi-user system you need a multi-terminal adaptor $525 (up to eight users). Each screen then needs a terminal adaptor cable $97. And the all important Xenix 5 operating system costs $1460. A math coprocessor costs $750.

Benchmarks

BM1	0.7
BM2	2.0
BM3	3.8
BM4	3.9
BM5	4.7
BM6	8.9
BM7	13.3
BM8	10.6

All Benchmark timings are in seconds. For a full listing of the Benchmark Programs, see End Zone.

Conclusion

The Sperry IT is, on the surface, just another AT compatible. It is, however, a good compatible. It provides enhanced functionality in some areas, as well as enhanced performance. More importantly, Sperry seems to be seriously pursuing the multi-user capability.

Personal Mapper should be of great interest to the corporate Sperry mainframe user. However, I am not sure whether it will be of interest to anyone else. END

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	Taimac Video Corporation	(09) 328 1988
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BANKS' STATEMENT

Hidden meaning

There's hidden depths to all those computer advertisements, if you read between the lines, or beneath the words, as Martin Banks discovers.

I can always remember being told at school something of great comfort. It was as follows: language is a living thing that is always vibrant, always changing. Grammar is just the remains of what language used to be.

That, I always thought, was one of the most poetic justifications for being lousy at grammar that I had ever heard, although at the time, it was a justification I needed desperately — for grammar and me seemed to be in entirely different worlds, most of the time. (There is absolutely no need for anyone to write in with comments about the present day, thank you very much; I am aware of my limitations).

The point of this little homily was, and still is, that language and the way in which we use it is constantly changing. The same often applies to words and their meanings. More specifically, it applies to what we *think* we mean with the current common usage of a word. This can lead to some interesting problems when the original meaning of the word is recalled.

The computer industry has, over the years, been a splendid exponent of this art of taking a word and fundamentally changing its meaning. More recently, our beloved industry has also adopted the use of words that attempt to suggest far more about a product than is *there*, if only because of the fact that if it weren't there, the company making it, wouldn't be selling it. See, it's all quite clear, really.

Here, to put it more simply, are two specific examples: the words 'sophisticated' and 'professional'.

These two words are used with stunning regularity by the computer industry, especially in promotional and advertising literature. You know the type of thing — 'the most sophisticated . . .', or . . .'a highly professional . . .' Such phrases abound in advertisements and press releases.

We read them blithely and know what the advertisers mean, or at least we *think* we know what they mean. The trouble is, words such as these have become such common currency that their meanings have become lost — if not to the *Oxford English Dictionary*, then to most of the people reading computer advertisements.

Take the word *sophisticated*, for example. What does it mean to you when you see it in an advert? Your immediate response might be that the word implies that the product in question is really 'rather clever', and that it will be able to do all the things you expect of it, given the limitations of its applications area (and some other things as well). Most of all, when applied to a product, 'sophisticated' is a word which implies something 'of class'.

A quick delve into the dictionary, however, will show that this couldn't be further from the truth. 'Sophisticated' derives from the word 'sophism', which means a 'false argument' or 'something intended to deceive'. Search a bit further and one finds that a 'sophist' is a fallacious reasoner, while 'sophisticate' means 'to deprive of natural simplicity', or 'to make artificial by worldly experience'.

These, it would seem to me, are not the kind of qualities one would naturally look for in a product, such as an applications program.

It is true that the word *sophisticated* also carries connotations of complication, especially when related to a product or a 'thing'. But even here, there is the implied expectation that the complication is 'necessary' and 'serving a valid purpose'.

This may be the case in practice, but let's look at some examples and use the original meaning of the word. Lotus, in a recent ad for 1-2-3 Release 2, says that its product is more powerful and sophisticated than the original (version). Can this be taken to mean that it has even more false arguments and fallacious reasonings, is even more complicated and less naturally simplistic? Worse, does it mean it is even more artificial?

Take some other examples. One company is advertising a sophisticated curtain-estimating package called Curtain Master: just imagine what this might produce in the way of finished goods given a little bit of false argument in the algorithm: 'I don't have windows the size of Sydney Cricket Ground. 'No sir, I understand that, sir. But just think, it gives you plenty of material for a nice hem.'

From a quick scan of recent adverts, 'professional' is the in-word at the moment. While current usage has not twisted its true meaning completely — as with 'sophisticated' — its use has come to imply something *extra-special* about a product that, if the reader thought about it, should be present all the time.

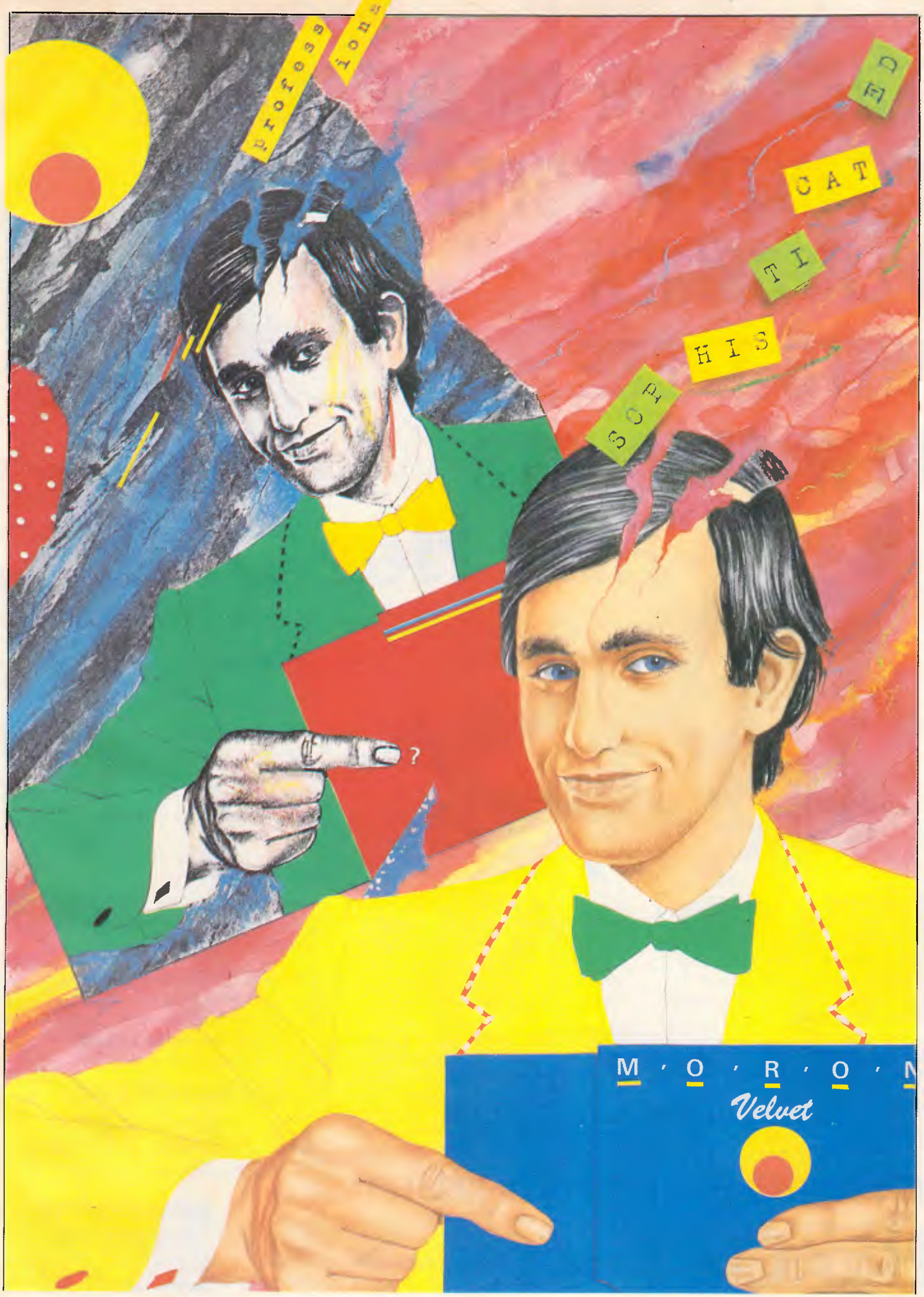
Let me give you an example. Two companies apply the word 'professional' to their graphics packages. One company states, that its package has a 'professional polish', which could be literally interpreted as 'the packaging comes from a furniture restorer.' The other company says its package is 'professional-looking', which probably means it's meant to be the art critic of *The Age*.

In both cases, what is meant is that the quality of the graphics produced is high, as one might expect from a professional artist. Well, isn't that what one ought to expect? Why spend money on a graphics package that has damn-all artistic talent?

Once you start looking at the words used in computer adverts and think about their real (or alternative) meanings, they become very interesting. Maxell, for example, writes about the 'staggering' 114 tests each floppy disk has to pass.

Just think: such word analysis could become a spectator sport for people in the industry, something to do in the evenings when the disk-drive has broken and only *Dallas* is on television. Why not read the adverts and see what you can really make them mean? Then, if it isn't dangerous or illegal, act out your conclusion in public.

END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SCREENTEST

Javelin

Javelin is a traditional but high-quality financial modeller which can compete with the market's best spreadsheets. Is it a serious rival to Lotus 1-2-3? Mike Liardet investigates.

Before the advent of personal computers and spreadsheets, financial modelling was tedious and expensive, with cryptic financial modelling software consuming a great deal of time. Understandably, since the arrival of the cost-effective and easy-to-use spreadsheet, the old-style financial modelling software has fallen into disrepute. There have been a few brave attempts to resurrect financial modellers on micros, such as Micropro's PlanStar, but none of these packages has enjoyed anything like the success of the top-selling spreadsheet systems.

I have long held the view that the traditional style of financial modelling has a number of advantages over spreadsheeting. However, in the personal computer market-place, where user-friendliness is paramount, these advantages have been eclipsed by poor user interfaces and crude implementation techniques in the products on offer. Until now, that is . . .

Javelin is the first traditional style of financial modeller to offer, on a personal computer, the kind of high-quality user-interface which has long been the norm for spreadsheets and other forms of personal software. With Javelin, the underlying 'logic' of the financial model is much simpler to build and easier to understand than in an equivalent spreadsheet. But its manuals, its range of facilities, and the organisation of the user interaction are on a par with the best spreadsheet systems, Lotus 1-2-3 included.

Javelin is the product of a new US company, Javelin Software, and is currently available only on the IBM PC. In its comparatively short lifetime, it has generated a great deal of interest in the US with Ashton-Tate finally landing the international distributorship. In Australia, Ashton-Tate has appointed Sourceware as the authorised dealer. Along the way, a fair amount of nonsense has been written on its supposed (but non-existent) natural language capabilities. These facts notwithstanding, Javelin is a significant development in the spreadsheet market, and Sourceware must have high hopes that it can use Javelin to prise away a fair slice of Lotus' 1-2-3 business.

'Lotus should look very carefully at Javelin as the first major challenge to its supremacy.'

In this review I'll closely compare Javelin with established spreadsheets, such as 1-2-3, to determine if it really offers that something extra which would make it the automatic choice for financial modelling.

Overview

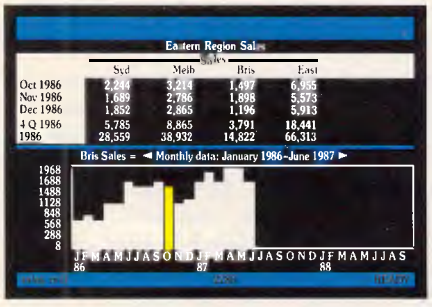
Javelin is intended for the serious business analyst, and can be used not just for performing calculations, but also for communicating to others the results and the reasoning behind these calculations. This contrasts with most spreadsheet systems where the logic behind the calculations is always difficult to read, even by the expert who created the model in the first place.

The most obvious feature of Javelin is that instead of restricting the user to a single, simple, rectangular worksheet, it allows him to work with a central 'information base' which can be seen through any of 10 different 'views'. The information base contains formulae, variables, data, notes, and so on, and the views enable this information to be displayed graphically, diagrammatically, or indeed, as a spreadsheet. It is important to realise that these different views all work with the same central information base, and just display this information in different ways. The user is always free to choose whichever view he wishes to work with, and in nearly all views, graphs included, he is free not only to see the information, but change it, too.

Formulae are one of the major components in the information base. In the 'formulae' view, formulae can be viewed either all together or selectively. There is a wide variety of functions which can be used in formulae — they are not limited to '+', '−', '*', '/', and so on. Unlike most spreadsheet software, Javelin formulae do not contain cell references, such as R37C43 or J47, but meaningful variable names such as Total Salaries and Net Profit. The formulae do not have to be maintained in any particular order (like the rows of a spreadsheet) — Javelin works out the order of calculation itself. In Javelin, the result of a formula must be assigned into a variable, which is supplied when the formula is first set up. Consequently, all Javelin formulae look like equations (for example, Profit = Revenue − Costs), where the left-hand side of the '=' has the variable to receive the result of the formula calculation.

Javelin does what you've always wished a spreadsheet could do.

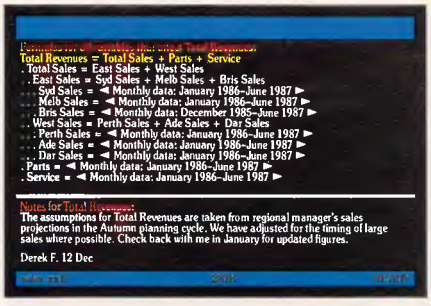
Introducing the next generation in business analysis software. Javelin, so much more than just a spreadsheet.



WORKSHEET AND CHART

Working from a central data base it will allow you to examine and analyse data in ten different ways — including worksheets, tables, diagrams, graphs, formulae, and more.

Javelin has an inherent understanding of time too. It enables you to convert financial information from days to months to quarters to fixed years. Or generate cash flow models based on accrued revenues or collections.



FORMULAE AND NOTES VIEW

GRAPH VIEW

This will free you to think about business the way you do when you're not using a spreadsheet — with an open mind.

DIAGRAM

But, most importantly, Javelin allows you to examine and validate the data and reasoning behind the financial models it generates. So your business decisions are based on accurate data and sound logic.

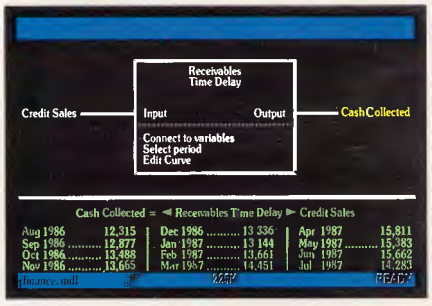


DIAGRAM AND TABLE

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A significant Javelin innovation is the 'diagram' view, which shows the relationship between the variables in the various formulae. The diagram view in Fig 1 indicates that Profit depends upon Revenue and Costs, and that Bonuses and Net Profits in turn depend upon Profit. Fig 1 does not show how these various variables are calculated — the formulae do that — but it does show the dependency relationships between the variables. Javelin automatically generates these diagrams from the formulae, and can 'window' their relevant parts when the whole diagram is too big for the display screen.

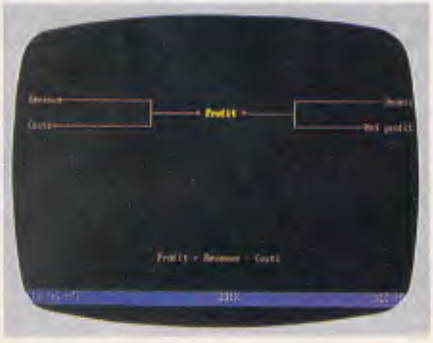

Fig 1 Diagram view of Profit

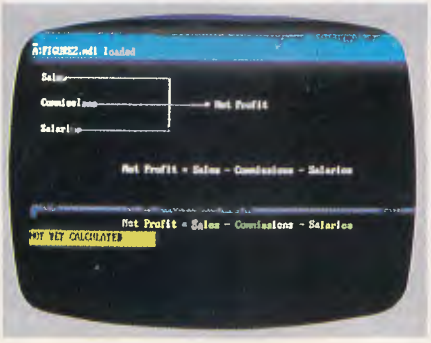

Fig 2 Diagram/table view

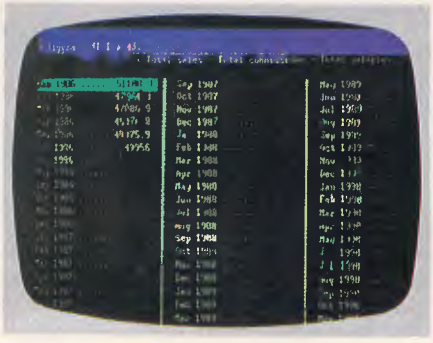

Fig 3 Table view of Net Profit

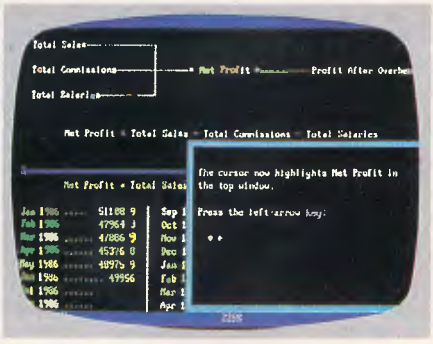

Fig 4 During a case study

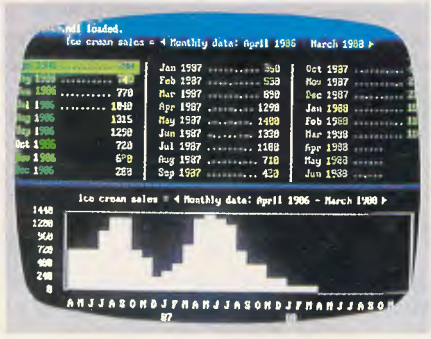

Fig 5 Chart/table view

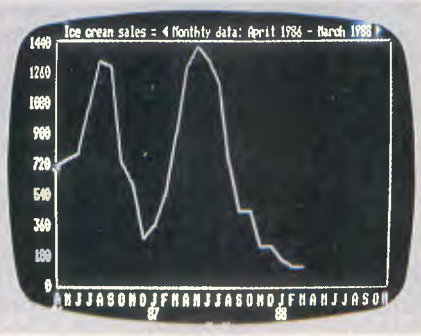

Fig 6 Quick graph view

Fig 7 Graph view of product sales

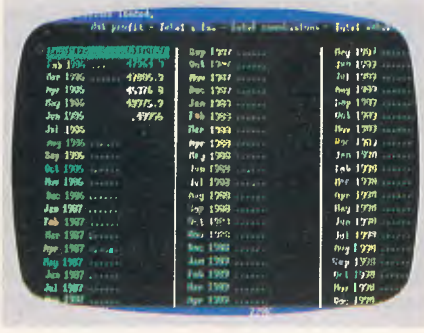

Fig 8 Spreadsheet view of sales

In financial modelling applications, it is not unusual to have variables with values that vary with time. For example, it is quite common to need to consider the performance of a company over 12 monthly periods, where clearly Profit and Sales, and so on, will all be different in each of these periods. In Javelin's 'table' view, it is possible to tabulate a number of different values for a variable. Javelin is already set up with an understanding of dates and time periods, so it is not usually necessary to first set up a time frame for a variable: the actual numeric values can be typed straight into the relevant months, weeks, or whatever. It is worth emphasising that the formulae used to calculate variables are the same for all time periods, so it is not necessary to replicate the formula for each month — Javelin knows that it should repeatedly apply the formula for each time period. This contrasts with spreadsheet software, where time periods are represented by columns across the spreadsheet, and formulae must be laboriously replicated from one column to the next.

Like many of the better spreadsheets, Javelin can generate graphs and charts from its data, and this accounts for no less than three of the possible views on the information base. With two of these graphing views it is not only possible to view the graph, but change it, thus updating a value in a variable. One of the views, 'chart', also operates with the standard non-graphics display card, but the other two require that the PC has the relevant high-resolution graphics capability.

The 'worksheet' view is Javelin's version of the conventional spreadsheet. In Javelin Software's concern to distance Javelin from spreadsheets, this view is rather under-emphasised. But as far as possible, bearing in mind Javelin's considerable differences from a spreadsheet, 'worksheet' operates much like any good-quality spreadsheet system.

The 'notes' view and the 'error' view are both Javelin innovations. The notes view enables an arbitrary amount of textual notes to be attached to any variable; these notes play no part in the modelling process, other than documentation. The error view homes in on formulae with calculation errors, and is useful for quickly pinning down mistakes in the logic of a model. All programmers know the value of placing comments in their programs, and always appreciate good tracing and debugging facilities. Similarly, in financial modelling, remarks and explanations can be

invaluable for current comprehension and future system maintenance — and it can also be extremely aggravating trying to track down the source of an error in the model. Hitherto, spreadsheets have offered no special help in these areas, so these Javelin notes and error facilities constitute a very useful 'first' by Javelin Software.

The tenth, and final, Javelin view is the 'macro' view. Javelin is not alone in providing macros — many spreadsheet systems have them. A macro is a sequence of instructions to Javelin, which can be set up once and re-run any time thereafter. In short, a macro is not unlike an ordinary computer program, and for that reason, it is a facility which tends to be used only by the advanced user who is prepared to develop the necessary programming skills to take advantage of it. However, when a macro has been created, it can readily be used by unskilled users, which is an important consideration.

It can be seen that Javelin provides all the usual facilities available in a powerful spreadsheet system, plus a number of bonuses, such as the diagram and error views. But to some extent, exaggerated talk of the 'information base' and '10 different views' is pure marketing hype — most of the views would be present in any good spreadsheet system.

In use

The user's first sight of Javelin is of an apparently over-documented product, including three manuals in a 3ins-wide library box. It is something of a relief to discover that the largest of the manuals is not a manual at all, but a ring-binder for the disks. There are actually only two manuals: a slim *Guide to Learning* tutorial; and a substantial, but by no means awesome, 300-page *Reference Manual*. No expense has been spared in the production of the manuals and the presentation of the material, but it is pleasing to see that, in contrast to Ashton-Tate's Framework or Lotus' Symphony, for example, the novice Javelin user is not faced with telephone directories of information to wade through.

There are nine Javelin disks: the system spans four 360k IBM disks, and there are three disks of 'case studies' tutorial material, a demo disk, plus a duplicate for the copy-protected system disk. Currently, Javelin is only available for the IBM PC and 100 per cent compatibles (Compaq is specifically recommended, and I can also vouch for the Zenith). Not surprisingly, with the weight of software provided, Javelin needs quite a substantial system — at least 520k of RAM and, unless you want to do a bit of disk swapping, a hard disk. Javelin allows expansion past the usual IBM 640k memory limit, with support for the Intel Above Board memory expansion. If you do have a hard disk, the copy-protection scheme allows the software to be completely copied onto it and used without any need for the copy-protected disk to be present thereafter.

The folder for the disks includes a leaflet giving very simple instructions for installing the system. This primarily involves a straightforward copying of the disks, but there is also a set-up procedure for various types of display board and printer. It is possible to use Javelin without a graphics display adaptor, but some of the graphics views will not be displayable. When the system has been installed, the *Guide to Learning* can be consulted for a gentle introduction to the system's capabilities.

'... a fair amount of nonsense has been written on its (Javelin's) supposed but non-existent natural language capabilities.'

After the ubiquitous copyright display, the standard Javelin screen display follows. Most of the screen is devoted to two views of the information base, and the top two lines and the bottom line are for information, editing and status display. Initially the diagram and table views are shown, but both are blank as there is nothing in the information base.

To start building up the information base, a formula might be entered. This is typed directly, with no preamble or menu selection. For example:
Net Profit = Sales − Commissions − Salaries.

The display is then updated (Fig 2). Net Profit becomes the current variable, and its two views are displayed. The diagram view shows that Net Profit is dependent upon Sales, Commissions and Salaries, and the table view states that Net Profit has not yet been calculated.

In order to calculate Net Profit, it will be necessary for Sales, and so on, to be given one or more values (or be defined as the result of further formulae). To set up values for Sales, the GOTO function key can be used, to 'GOTO Sales'. Javelin is supplied with a plastic template which, on an IBM-style keyboard, will fit around the 10 function keys; this identifies F5 as the GOTO key. Press F5 and then type 'Sales', and Sales becomes the current variable. The diagram view remains unchanged, and the table view shows an empty table but with all the possible year+months for Sales already in place. Javelin assumes, by default, that it will be used on monthly models, and also selects the current month and year (from the date set when the computer was switched on) as the first period.

The table view defaults can easily be changed, and it is possible, using the arrow keys, to move either forwards or backwards in time (between 1904 and 2082). The current month and year is always indicated by highlighting on the display, and the highlighted period moves accordingly. When the correct period has been found, a relevant value can be entered by typing one in. Several values can be entered, if required.

A similar approach can be used to set up values for Commissions and Salaries. It is not strictly necessary to set up values for the same time periods in all the variables, but when the calculation is made (press a function key to do it), Net Profit can only be calculated for the periods for which all its input variables have defined values. The newly calculated values for Net Profit are automatically tabulated, and can be displayed by typing 'GOTO Net Profit' (Fig 3).

All the above can be achieved within 20 minutes of taking the wrapper off the package, so it can be seen that it is very easy to get started with Javelin. But to make life even simpler, the novice can take a first look at Javelin through the case studies disks. These offer 17 interactive half-hour tutorials, ranging from an 'introduction to...' through to more advanced topics, such as time delays and importing data.

It isn't necessary to install Javelin in order to use the case studies, nor is it really that important to first copy them, so they can be used straight out of the box. When a case study is running, the user is presented with a snapshot of a Javelin screen, overlaid with an explanation and instructions of what to type in order to achieve the desired effect, as if he were using the real system (Fig 4). Javelin checks the keystrokes and beeps if any mistake is made, but if the user wants to quickly press ahead he can use the space bar, which works as a substitute for any key. Unlike some tutorial systems, the user can freely move backwards or forwards throughout the lesson, or even abandon it altogether, but there is no flexibility enabling you to deviate from the pre-ordained path of the lesson and experiment with any variations.

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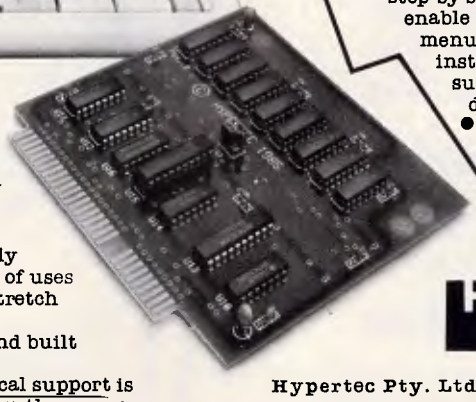

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APC

The case studies provide an excellent overview of Javelin's capabilities, as well as familiarising the user with many of the keystrokes and interactive techniques needed to drive it. There are two sets of introductory lessons on offer: one for users with spreadsheet experience; and the other for those without. I could find no difference between the two sets of lessons, and was unable to decide whether: (a) I had overlooked some subtlety; (b) Javelin had slipped up; or (c) it was all a private Javelin joke. As the introductory lessons seem to be eminently appropriate, regardless of the user's previous experience, I am inclined to believe the latter.

Graphs and charts

Javelin gives a great deal of flexibility in managing the display of the various views: changing the relative sizes of the two principal areas; allocating the entire screen to just one view; synchronising both views so that they always focus on the same variable; or having different parts of the same view simultaneously on display. But by far the most visually stimulating aspect of Javelin displays are the graphing options. There are three graphics views: 'quick graph', 'chart' and 'graph'.

The most basic of the three views is chart, which displays a bar chart for a single variable (Fig 5). The chart is built up from the PC's standard graphics-character symbols, so this view can be seen even if a graphics display adaptor is not fitted to the computer being used. Javelin decides the scaling and other display details automatically, so chart is simple and quick to use.

The chart view is an exact graphical counterpart of the table view; and the bar chart is not just a passive display, but it can be changed as well. Javelin permits this facility by arranging for one bar in the chart to be highlighted as the current action point. By pressing the up and down arrows, the bar size can be changed, with the underlying value in the information base updated accordingly. The action point can be moved using the left and right arrow keys, and bars can be deleted or inserted using the keyboard's Insert and Delete keys. For precision changes in value, an actual number can be keyed in. It would be quite possible to build up an information base without ever using the table view, and just using the chart view instead. This method of data entry is particularly appropriate when exact figures are not known, but where the user has some intuition for the shape of the data.

The quick graph view works in the same way as the chart view, but displays the variable as a line graph instead of a bar chart (Fig 6). This view requires a graphics adaptor and always uses the whole screen, therefore it cannot be displayed alongside another view. But apart from these two minor considerations, quick graph can be used in much the same way as chart — it too provides the facility to graphically modify values. The table, chart and quick graph views are all functionally identical — it is only the way in which they display the information that differs.

Javelin's graph view is intended for the production of high-quality presentation graphics. As such, the layout is not automatically decided by Javelin, but must be set up by the user before the graph view is selected. In contrast to the other two graphics views, several variables can be displayed simultaneously; scaling and annotation can be specified; and there is a variety of display styles to choose from, including pie charts, stacked bars, XY plots, and so on. Fig 7 illustrates some of the 'bells and whistles' on offer.

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Spreadsheeting

Javelin's information base can be displayed and modified from a worksheet view (Fig 8). It is not completely straightforward to get started with the worksheet view, as before any information can be displayed, the row and column headings must be set up to indicate just what parts of the information base are required. In some ways, this is a good feature, as the spreadsheet can readily be set up to selectively display just the major variables, but it would be more convenient if the default display included everything (and it would be easy to delete what is not needed), rather than nothing (where it's harder to include what *is* needed).

When the row and column headings are present, the spreadsheet can be manipulated in much the same way as an orthodox spreadsheet. Column widths and numeric display styles can be changed; rows and columns can be inserted or deleted, and so on. Of course, the spreadsheet is drawn from the underlying information base, and the formulae operate on whole rows and not just cells, so there have to be differences. However, an experienced spreadsheet user will quickly feel at home working with this view.

Number crunching

Javelin provides a rich selection of arithmetic operators, and specialist financial and modelling functions. Most of the operators and functions can be applied either to single-valued or multiple-valued variables. Here is a small selection of some of the available functions:

*Minimum, maximum, average and sum — calculate the minimum, maximum, average or sum of a list of expressions.
*Bond price — calculates the price of a bond, given its yield, face value, coupon rate, time to maturity, and number of payments per year.
*Yearly, quarterly, monthly, weekly and daily — enable expressions to operate on variables defined over differing time spans. For example, a personal budget may have to deal with regular monthly, quarterly and annual payments, and these functions can be used to interpolate the less frequent payments into a monthly model.
*Standard deviation, variance and correlation — a variety of built-in statistical measures.
*And, if, or, not — simple logical manipulations.

Conclusion

I am greatly impressed with Javelin. For financial modelling, it offers everything that would be provided in a top-quality spreadsheet system such as Lotus 1-2-3. Like 1-2-3 it has spreadsheeting, graphics and macros; a top-quality user interface; and sound, clear documentation. But it also scores over 1-2-3 with a number of facilities to greatly clarify the underlying logic of a model, and also with powerful facilities for building and manipulating time frames — an essential part of financial modelling.

On the debit side, Javelin does require a fairly substantial PC as a minimal system, and it would not offer 1-2-3's modelling flexibility if used outside the financial arena.

If I were marooned on a desert island with an IBM PC and only the choice of just one spreadsheet with which to monitor my accumulating investments at home, which one would I choose? By a whisker, I would forego the security of 1-2-3's entrenched market position, and select the new product with the excellent model-building facilities — Javelin.

However, I would be surprised if Javelin were to usurp 1-2-3's position in financial modelling, in the way that three years ago, 1-2-3 superseded the original market leader, VisiCalc. Unfortunately for Javelin Software, 1-2-3 has now become a standard in its own right, and people will buy it for that reason alone. But Lotus should look very carefully at Javelin as the first major challenge to its supremacy.

Javelin is supplied in Australia by Sourceware, 4/73 Albert Avenue, Chatswood NSW 2067. Tel: (02) 411 5711. It costs $1095.

A Javelin Trial Pack which includes an abbreviated manual, a fully operational copy of Javelin (limited to 20 variables), costs $39.50.

END

Sidecar

Sidecar is the latest add-on for the Commodore Amiga which promises PC compatibility resulting in a trove of much needed business software. Phil Cohen reports.

It wasn't that long ago since the Amiga itself was released in this country. A 68000-based windowing machine from Commodore, with a lot of extra power provided by special purpose chips for sound and graphics generation. At first glance it looked like just another sophisticated games machine: after all, what business application needs graphics animation and stereo sound?

However, looking further into the works revealed a powerful and flexible tool with virtually no software available for it: a blank piece of paper onto which developers could write powerful applications.

One of the first questions people asked when the Amiga came onto the market was the inevitable: "is it IBM PC compatible?" For a personal computer today, that's a question which is almost as important as the price of the unit.

When the Amiga first appeared, the answer to the above question was a simple 'no'. There was a piece of emulation software called Transformer which allowed you to run a limited selection of MS-DOS applications, but that was all. Even Transformer hasn't been released here, some months after the Amiga's release, which is some indication of how much planning Commodore missed in answering that all-important question.

Sidecar is (Commodore claims) 100 per cent software and hardware compatible with the PC.

Basically, the Amiga is a machine looking for a market. Commodore admits that rather than looking for a niche and then trying to fill it, Commodore let their boffins run with whatever ideas they had, and then hoped that someone would figure out why the machine had all of those features. Confusion was rife, with one senior Australian official saying that the Amiga was going to be aimed at the business market.

Now Commodore has modified that, saying vaguely that it's aimed somewhere between the education (a lot of early sales are to universities and other research bodies), business (can't ignore business, with the home games market in reverse) and entertainment (even businessmen get bored sometimes) markets. With a fuzzy aim like that, no-one would be surprised if it missed altogether.

However, to be fair, the Amiga is such a powerful machine, and so different in capability from almost everything else on the market at the price, that it's a fairly safe bet that enough uses will be found for it to keep afloat.

For example, in Australia alone there are developers working on vertical market projects such as a dental accounting package with graphics (of teeth, one assumes), an animated logo editor, a graphics-based security system, a 4GL (the Amiga hasn't got one yet!), a multitasking telex management system and some computer-aided instruction software.

However, developers are not software, and anyone thinking of buying an Amiga for business use should know that there is currently very little business software around. Although Commodore proudly points to the over 200 developers busily working on packages in the US, the acid test is to ask the question "is it available off the shelf in Australia?" to which the answer is "no".

What *is* available here is a very limited choice of ex-PC packages which have

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been 'ported' across (recompiled from the C original, in most cases), including a variety of statistical software, animation and graphics works.

Apart from that, there is not much around at all. Around 2000 machines have been sold in Australia so far, and Commodore says that about a fifth of those have gone to domestic hobbyists, and the rest to engineers and research types.

So without that all important PC compatibility, the Amiga is going to be stuck right out on a limb, picking up the odd very vertical market slot.

This brings me to Sidecar. With the failure of Transformer (it runs slower than a PC — even using the power of a 68000 — and isn't anywhere near 100% compatible), Commodore decided to do something radical.

Hardware

Sidecar is no more nor less than a PC without a keyboard or monitor. It attaches to three sockets on the right of the Amiga's main box and contains one 5in drive (the Amiga's drive is a 3.5in type). Seeing this I was strongly reminded of the quote in "Soul of a New Machine" in which a new model of computer is described as the same as the old model but with a bag on the side.

Sidecar is (Commodore claims) 100 per cent software and hardware compatible with the PC. It runs the Phoenix BIOS, which is about as software compatible as you can get without actually being kosher, and has three PC-compatible slots which can be used for any compatible add-on card.

There are four keys on the IBM PC keyboard that are not on the Amiga, but can be simulated by pressing various combinations. Once you learn the sequence, you are ready to roll.

The sockets on the side of the Amiga into which the Sidecar plugs are the mouse, joystick and main bus sockets. The mouse and joystick sockets appear again on the front of the Sidecar. Both processors share the same printer socket. The whole thing looks a little unwieldy and takes up a fair amount of desk space.

A second 5in drive, or an IBM-compatible 3.5in drive can be plugged into the back, and of course the slots in Sidecar can take a hard disk drive expansion. If you want to use a graphics card in the PC slots, you naturally enough have to add your own monitor.

Sidecar has its own 8088 processor, and will support the 8087 maths coprocessor chip as well. It comes with 256k RAM, and runs at the same clock speed as a PC (so there's no point in running benchtests — Ed). It will retail at approximately $799, bringing the total price of an Amiga plus Sidecar system to over $3000.

System software

To run Sidecar, you simply boot up the Amiga as usual. The operating system is based on the now-familiar Macintosh desk and windows, with pull-down menus and so on. By selecting an object that looks like a PC, you can open a window to the PC's operating system. By enlarging the window to the full size of the screen, you can start using the Amiga just like a PC, loading software into the 5in drive on the Sidecar, and forget that you're using anything but an IBM.

When Sidecar is released in Australia in August, there will be no way of transferring files from the Amiga to Sidecar or vice versa.

Now, the Amiga is a true multi-tasking machine. It is possible to have a number of programs actually in progress in different windows at the same time. The processor will share itself between the windows, so that all programs will progress at the same time. Beware of imitations — operating systems like GEM are *not* truly multi-tasking, and will stop all other programs while working on the one 'active' one in the window which you have selected.

So is it possible using Sidecar to have more than one MS-DOS window operating at the same time? Unfortunately, no. You can have more than one MS-DOS window open at one time, but since it's the 8088 and not the 68000 which is running the windows, and since it's a standard BIOS, all of the other MS-DOS windows are 'frozen' while the active one is working.

However, it is also possible to have any number of Amiga windows operating at the same time and still have an MS-DOS window running — since there are two separate processors there's no real trick to that. In fact, it's possible to actually reset either machine without affecting the operation of the other. That's the degree to which the Amiga and Sidecar are separate.

You can size and drag MS-DOS windows around the Amiga screen, and do a number of other nice things. You may alter any of the 16 colours to whatever you like, make some windows use less colours (which makes it easier for the 68000 to handle the graphics calls, and therefore speeds things up), alter the cursor flash rate, and so on.

All in all, the operation of the MS-DOS windows is fully integrated into the Amiga environment. Now for the surprising part. When Sidecar is released in Australia in August, there will be no way of transferring files from the Amiga to Sidecar or vice versa.

One of the main reasons for equipping a machine with IBM PC compatibility is to allow interchange of at least data files (if not actually software) between them. Commodore has done a very good job of integrating an operating MS-DOS machine into the Amiga and then left out one of the major drawcards — file interchange.

Why this has been allowed to happen, goodness only knows. The hardware is certainly capable of it — the 68000 processor actually handles all of the screen output from the Sidecar, so there is a channel of hardware communication. It's just a question of software.

Commodore tells me that within six months of its release, all existing Sidecar owners will be given a software upgrade which will allow users to exchange files between the Amiga and the Sidecar. I'd be a lot happier about that statement if Transformer had been released.

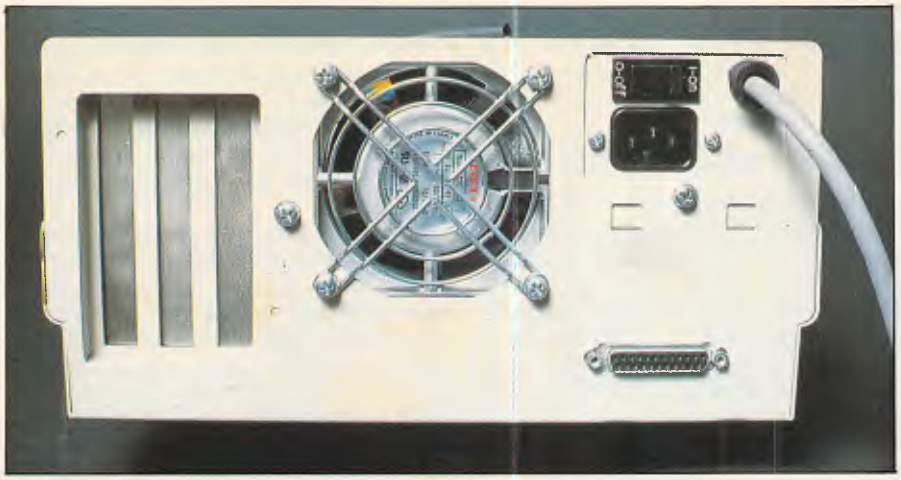
Buying a Sidecar now is like buying a PC clone off the shelf — except that it's a bit cheaper (and no-one is sure just how much cheaper).

According to Commodore, the problem can be solved by using what they call "hybrid mode", in which the two machines melt together into one super-

In perspective

The big competition for the Amiga is Atari's ST, a machine similar in approach and in abilities (although this is hotly debated). The Atari has not done particularly well in the US, possibly because of the company's 'alien shootout' image there, and not a lot has been heard of it in Australia either.

Putting Sidecar into perspective is a little difficult because of what appears to be a rather vague marketing strategy, but it seems to be aimed mainly at reassuring Amiga buyers that they will not have a totally useless machine if no good software appears for the Amiga (which in any case is unlikely).



Three expansion slots and a fan dominate Sidecar's rear

machine, in which the 68000 can use the 8087 coprocessor, the 8088 can drive the Amiga's wonderful custom chips, and a hard disk in the Sidecar can be split between the Amiga and MS-DOS functions. How do users get access to this wonderful state? They wait for applications developers to write software to use it.

All of this points to the fact that the Amiga is a piece of hardware waiting for applications. True, it's a very powerful piece of hardware, but that does not make it useful in the marketplace. In a year or so the Amiga (and, it has to be allowed, the Atari ST) will be out-running PC clones in a number of selected vertical markets, but not until the software is right.

Rumour has it that, not content with having one machine on the market with next to no applications software, Commodore is going to upgrade the Amiga (towards the end of this year), and include the Sidecar in it. (Just like those Apple clones which ended up with a Z80 card built in on the motherboard.) The new machine will have the ability to swap files between the two operating systems.

What users are supposed to do with the Sidecar until the software is ready is anyone's guess. According to Tony Cuffe, National Products Manager for Commodore in Australia, part of the reason for releasing the Sidecar was to give existing (and potential) Amiga users a "comfort zone", to give them the feeling that they weren't going out on a limb by buying a machine which couldn't emulate an IBM PC.

Having criticised Commodore's marketing of Sidecar, I have to conclude by saying that it's an excellent product.

Having criticised Commodore's marketing of Sidecar, I have to conclude by saying that it's an excellent product. A lot of thought has gone into the integration of MS-DOS into the Amiga operating system, the box looks fairly well engineered (but why didn't they put the disk drive vertically to save desk space), and it runs any piece of IBM compatible software you care to mention. Although I couldn't see the documentation (it's not printed yet) if it's up to the Amiga standard it will be far above the rest of the market.

Technical specifications

Processor:	8088, with optional 8087 maths coprocessor
Clock:	Standard 4.77MHz
RAM:	256k standard, 640k maximum
Operation system:	MS-DOS
Expansion:	three IBM PC-compatible slots

Prices

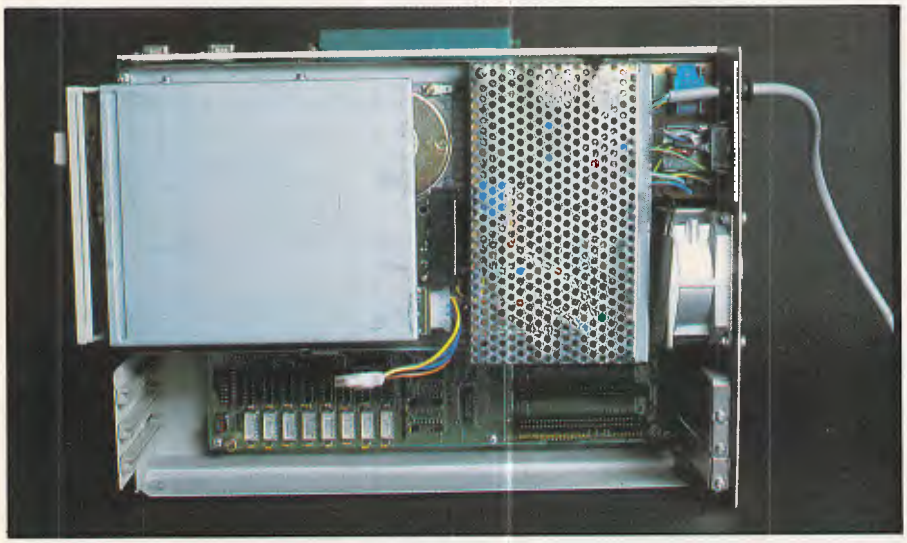
As already mentioned, Commodore is saying only that Sidecar will cost approximately $799, but indications are that that figure might be a little pessimistic.

The predicted total price for an Amiga plus Sidecar is $3200, for which you would effectively get a colour PC clone plus an Amiga.

Conclusion

The Amiga is a very nice machine, and the Sidecar is a *very* nice add-on. However, a computer is only as valuable as what you can do with it, and on that basis, until Commodore releases software to allow file interchange, and until developers produce some good applications for the machine, it's only worth watching and waiting for.

END



Inside Sidecar

YANKEE DOODLES

David Ahl sifts through the best of the new US releases, and presents the other headline news from the States.

What's new

Apple has introduced a new entry-level Mac, the Macintosh 512k Enhanced, which incorporates several features of the Macintosh Plus including an 800k disk drive, a hierarchical file system in ROM and increased performance, particularly in disk I/O. The $US1999 price is the same as the earlier 512k Mac, but doesn't include MacPaint or MacWrite software.

General Computer Corp has introduced several new versions of its Hyperdrive hard disk for the Macintosh Plus. The line now includes two internal drives of 10Mbytes ($US1399) and 20Mbytes ($US1699) as well as a top-end system, the Hyperdrive 2000, with a 20Mbyte drive, a 68000 co-processor board and 1.5Mbytes of memory ($US3199).

A tiny company, Data Pacific, demonstrated MacCartridge at the West Coast Computer Faire. This nifty product plugs into an Atari 520ST or a 1040ST and emulates a Macintosh. A few Mac programs, especially ones with sophisticated copy protection, won't run with Mac Cartridge, but most will: Microsoft Excel, for example, runs 20 per cent faster on the ST than it does on the Mac. Currently, the company is trying to work out a deal with Apple to use two proprietary ROM chips. Selling these chips to Data Pacific would seem to be to Apple's advantage, as it would virtually establish the Mac operating system as the standard in the 68000 arena.

IBM has finally released its long-anticipated lap-held portable, the PC Convertible (reviewed last month). The machine has an 80C88 MPU, 256k of memory (expandable to 512k), two double-sided, 720k 3½in. floppy disk drives, a fold-up 25-line by 80-character screen, a 78-key keyboard, and rechargeable batteries which last for six to 10 hours. Weighing an arm-stretching 13 pounds, the machine costs a wallet-thinning $US1995.

An enhanced version of True Basic has been released which supports the Hercules graphics card in the IBM PC. This is the first Basic language to allow users of Hercules and other graphics cards to access a full 640k and the 8087 co-processor. The graphics syntax is said to be hardware-independent, so graphics developed on the system are directly portable to the Apple Macintosh, the Commodore Amiga and the Atari ST. Price is $US189 for the complete package or $US39 for an upgrade.

Quadram has unveiled Supersprint, an 8086 accelerator card that allows 8088-based computers such as the IBM XT to operate with the speed of 80286-based machines such as the IBM AT. The $US695 price should drive down the $US1200+ prices of some of the 80286-based accelerator boards.

Brightbill-Roberts has introduced Show Partner, a memory-resident graphics editor for the IBM PC. The package combines extensive animation capabilities and a 'slide show' manager with the features of the company's previous Grafix Partner graphics editor package. In the slide show mode, image transitions include replace, wipe, split, box, scroll, fade and weave. Show Partner supports IBM and most third-party graphics cards; price is $US149.

High-tech sting

Despite the enactment of computer crime laws in most US states, fewer than 100 cases have been prosecuted. Moreover, of the computer criminals who are prosecuted, few ever go to jail or pay major fines. However, some interesting facts have emerged from the prosecutions. Most crimes are committed by programmers, students and input clerks with an average age of 22. The most common target for malicious tampering are commercial companies, banks, telecommunications companies and government agencies; the average incident causes $US93,600 worth of damage.

As a result of the growing frustration in trying to track down malicious hackers, a number of police agencies throughout the US have set up 'underground' electronic bulletin boards. One, devised and run by Sgt Dan Pasquale of the San Francisco Police Department, has attracted a wide collection of system passwords, account numbers and long-distance access ports. Recently, seven suspects in the Silicon Valley area, none older than 18, were arrested and charged with possession of stolen property, and trafficking in unauthorised credit card numbers and long-distance access codes.

CD-ROMs poised

To date, only 11,000 CD-ROM players have been shipped worldwide, the majority of which have gone to developers and system integrators. At a recent CD-ROM conference sponsored by Microsoft, over 900 developers and publishers gathered to talk to one another and hear about the latest projects. Most agreed that there are few commercial products to attract the average user today, but the market is poised on the verge of enormous growth.

Gary Kildall, inventor of the CP/M operating system and co-founder of Digital Research, was the keynote speaker at the conference. A leading proponent of videodisk technology, he has started a new company, KnowledgeSet Corp, which has recently introduced a CD-ROM electronic encyclopaedia. His company has also established a joint venture with Sony in which KnowledgeSet will offer data preparation services, and Sony will master and reproduce the disks. Kildall believes that the key to making CD-ROMs successful is to make it easy for existing publishers to transform their current materials into CD form, and then work with the CD-ROMs to take advantage of the multi-media capabilities.

One early CD-ROM on the market has been put together by the Personal Computer Software Interest Group (PC-SIG), which claims to be the world's largest distributor of user-supported and public domain software. It offers its entire catalogue of 479 programs on a single CD-ROM for $US195. In addition to the software, PC-SIG offers a Hitachi CD reader for $US995; this includes software for using the reader with an IBM PC.

Other CD-ROMs currently available are mostly specialised databases.

Random bits

Apple has reduced its 2600 US outlets by 600 stores in an effort to eliminate weaker outlets and those who have been wrongly cutting prices... Lotus has cut the price of Jazz from $US595 to $US395 to put it more in line with Microsoft's Excel package which has been outselling Jazz in several markets... US Apricot, having never shown a profit and having recently laid off one half of its employees, has been purchased by two former employees. They plan to distribute Apricot products as well as other brands, including a Xenix-based machine... Good news and bad news among the old-timers: Kaypro, following a shift in emphasis from 8-bit CP/M machines to IBM PC compatibles, has reported a nine-fold jump in profit in its latest quarter... Meanwhile, Morrow Designs has filed for creditor protection under Chapter 11 of the Bankruptcy Code, just two weeks after the IRS (Internal Revenue Service) awarded Zenith a $US27 million contract for 15,000 Z-171 lap-helds, a design that Zenith purchased from Morrow last year for a minuscule $US1.2 million... The last of Osborne Computer Corp's office and manufacturing equipment was sold in mid-April to a liquidation firm... IBM's introduction of Topview 1.1 shows that the company is committed to the product, but critics point out that Topview still does not support a total graphics environment and is not compatible with IBM's token-ring network...

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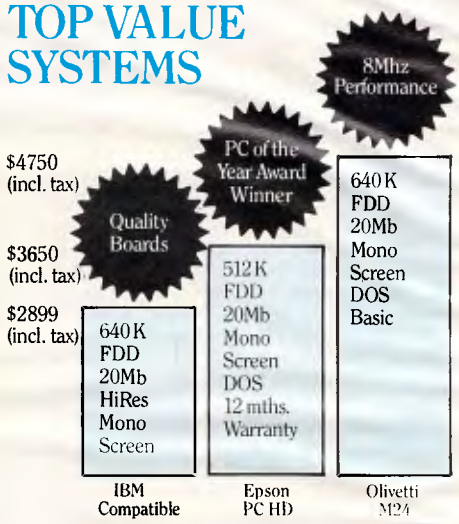

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SCREENTEST

Turbo Prolog

Borland International, creator of the whirlwind Turbo Pascal, is constantly stacking success upon success. The company's latest product, Turbo Prolog, holds great promise. Ian Davies puts it through its paces.

Prolog belongs to a family of languages known as 'Logic Languages'. In fact, its name derives from that classification: PROgramming in LOGic. Another similar language is Lisp, which specialised in list processing and embodied the same major philosophy as Prolog. Lisp has dropped in popularity over recent years, mainly due to the emergence of Prolog and the directions of the Japanese ICOT project. The first version of Prolog was implemented in 1972 by Alain Colmerauer of the University of Marseilles, written in Algol-W. His colleague, Roussell, went on to build a more efficient Fortran version in 1975. Since then, several institutions have created their own implementations, mainly for large to medium size mainframes.

It is only recently that Prolog has become available on microcomputers — even on the ZX Spectrum. As well as looking at Turbo Prolog, we will also compare it with two other Prologs for the PC.

PROgramming in LOGic

Logic languages are something new.

Anyone who knows more than a couple of languages quickly comes to realise that all conventional languages are merely variations on a theme. Compare Cobol, Fortran, Basic, Pascal, any assembler, dBase and C. Programming in all of these is very similar, even though their syntax may vary. For example, writing a program to count up to ten in any of the above would entail very similar processes. They all have various types of loops — WHILE, FOR, REPEAT, GOTO; they all have conditional statements — IF, CASE and GOTO; they all have data structures — arrays, records, sets and files. In short, they all consist of things to be done.

They are all so similar because they reflect the architecture of the machines for which they were designed. That is, of course, the classic Von Neumann architecture. John Von Neumann, in 1947, formulated a method upon which are based all computers. Coincidentally, Charles Babbage came up with the same ideas 100 years before. Simply, all computers are designed in much the same way, and this has been true for more than 150 years. This design has heavily influenced the style of computer languages — to such an extent that it's not immediately obvious.

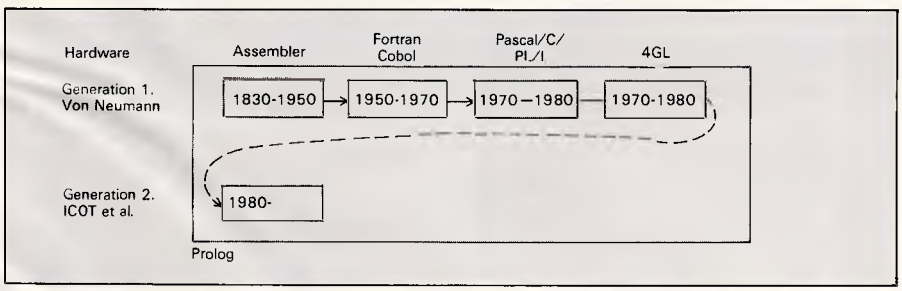

Figure one: the development of hardware & software technology

Now for the interesting bit. One of the attributes of Von Neumann architecture machines is that they tend to be good at things people are not good at (being accounting systems, spreadsheets, sledgehammer mathematics), and tend not to be good at the things people are good at (language understanding, pattern recognition, theorem proving, deduction and so on).

This is a direct result of the underlying principles upon which the machine is constructed.

Jump now to the 1980s. Japan announces its ICOT project to develop the Fifth Generation Computer. Unfortunately, due to marketing men, everyone gets very confused and thinks that they are developing something beyond the Fourth Generation Language. Indeed, more than one hardware company has been advertising their box as 'the Fourth Generation Computer', so it's not surprising.

Probably Japan named its project incorrectly. It should have been called 'Second Generation' — no doubt the marketing men had some influence yet again. Anyway, before long, everyone realises that they're actually doing something new, and other countries and consortiums announce their own projects. They realise that its crucial to the future, as they all want to do increasingly complex things with their machines, and the Von Neumann architecture requires increasingly fast hardware. The current state of the art in hardware has only got another order of magnitude improvement left in it before it starts to poop out, due to things like relativity and quantum mechanics. Of course, a completely new branch of physics may be discovered which removes these limitations, but in the

meantime, people are pushed to unwieldy solutions such as multiple processors and pipelining to get the required speed.

These researchers are developing 'Second Generation' machines (as against 'Fifth Generation') because they will be the first ever machines which do not follow the classic Von Neumann architecture. This means that our current ideas about what computers are good at, what is easy and what is difficult for a computer to do, will no longer necessarily be correct.

So where does Prolog, running on a Von Neumann architecture machine, fit in with something so new that we don't even know what it will be capable of?

Prolog itself is something new. Its basic philosophy is *totally* different to any other language you will have used (except for people who have already used Lisp and the like). What's more, it is so different that it performs very badly on Von Neumann architecture machines, PT (Pre-Turbo).

Prolog is called a 'Fifth Generation Language', and once again thanks to the marketing men, everyone has got confused and thinks a 5GL is something you graduate to from a 4GL. It's not. A 5GL is something which runs well on fifth generation hardware. A 5GL is the assembler for the hardware of tomorrow.

Figure one shows the true development of hardware and software technology. The diagram does not imply that the creation of a new software tool supersedes the old tools — that is surely not the case — but one certainly builds upon the other. In short, it's back to square one with a completely new ball game. Languages such as Prolog, by simulating the new architecture on the old, act as a transition aid.

Prolog and Lisp both draw a distinction between 'imperative' and 'descriptive' programming. Traditional languages basically specify a list of things to be done. Indeed, this is often the analogy used in Programming 101 — "think of a program as a recipe or a shopping list".

Traditional languages actually have both descriptive and imperative components, but are typically 90% imperative. A good example of a descriptive construct is the humble arithmetic expression, for example: X=(Y/Z)+((T+I*P)/(Q+1)). This describes the calculation to be performed, but says nothing about the methods used to do it. It is a concept which exists happily in a scope outside that of the program it lives in.

Prolog is 90% declarative and 10% imperative. That is, most of the program describes the rules and the facts which surround the problem, and only 10% are concerned with how to solve it.

That may not sound so different to you, but consider: no loops, no conditional statements, no real variables. The result is something the average philosophy student would feel more at home with than a computer science graduate. For example, my first attempt to write a program which counts up to ten and then stops (done several years ago under a very old Prolog) was a real effort, and took several goes to get right. Another example of how different Prolog is: as well as giving a program some input, and receiving its output, you can often give the same program some output, and it will generate the input. In other words, programs are often reversible.

In summary, Prolog is new. It's different. It's the way of the future, and if you still want to be in computer industry to any extent 10 years from now — it's something you should know about.

No foolin'.

Other Prologs

As I have said, Prolog has been around for 14 years now, mainly confined to large minis and mainframes. The first

micro version appeared in 1980, and is still available today.

Whereas the speed of normal machines is measured in MIPS (Millions of Instructions Per Second), and the speed of vector processors is measured in MFLOPS (Millions of Floating Point Operations Per Second), logic machine speeds are measured in LIPS (Logical Inferences Per Second).

Due to the problems of running languages such as Prolog on machines which really weren't designed for the task, Prolog systems tend to run rather slowly. For example, it is said that an Apple II can do about 60 LIPS, and a large IBM mainframe capable of 20 MIPS can do about 20,000 LIPS. This is why languages such as Prolog have not been much more than an academic curiosity until now.

The reason Turbo Prolog is so important is threefold. Firstly — it's fast. So fast in fact, that on a normal IBM PC, it can outperform the specially developed hardware the Japanese have come up with to date (the 'Inference Engine'). Secondly, it's practical. The other Prologs have been sadly lacking in real world facilities, the sort of (trivial) things people need to do if they're going to write real-world software in a language. Finally, it follows Borland's standard approach to marketing: quality at a reasonable price.

This means that people are going to go out and buy Turbo Prolog. We were supposed to get the first copy of Turbo Prolog in Australia, but weeks before it arrived, two friends had already purchased it directly from the US. I suspect that this is a common occurrence with Borland products.

It also means that there will be hundreds of thousands of clever people out there all playing around with Prolog who would not otherwise have done so. We're going to see expert systems appear by the dozen, and some of them are going to be really good. The AI market is going to get a real shot in the arm. Sooner or later, some of these people are going to start discovering new things which can be done with logic languages. It's going to be like VisiCalc all over again.

Turbo Prolog

Turbo Prolog is window driven, so you can see your program, dialogue, messages and traces all at the same time. As you step through a program, the cursor can be automatically positioned at the source line being used. It is a compiled implementation, and can do the Turbo Pascal trick of compiling to memory or to an .EXE file. The resulting .EXE files can be run stand-alone, and can even be linked with other languages, including Turbo Pascal version 4, which will be able to produce .OBJ files for the linker. It comes with its own built-in editor, and it is one of the most readable Prologs around.

In addition to providing all the normal Prolog facilities, Turbo uses the idea of 'domains', which loosely corresponds to

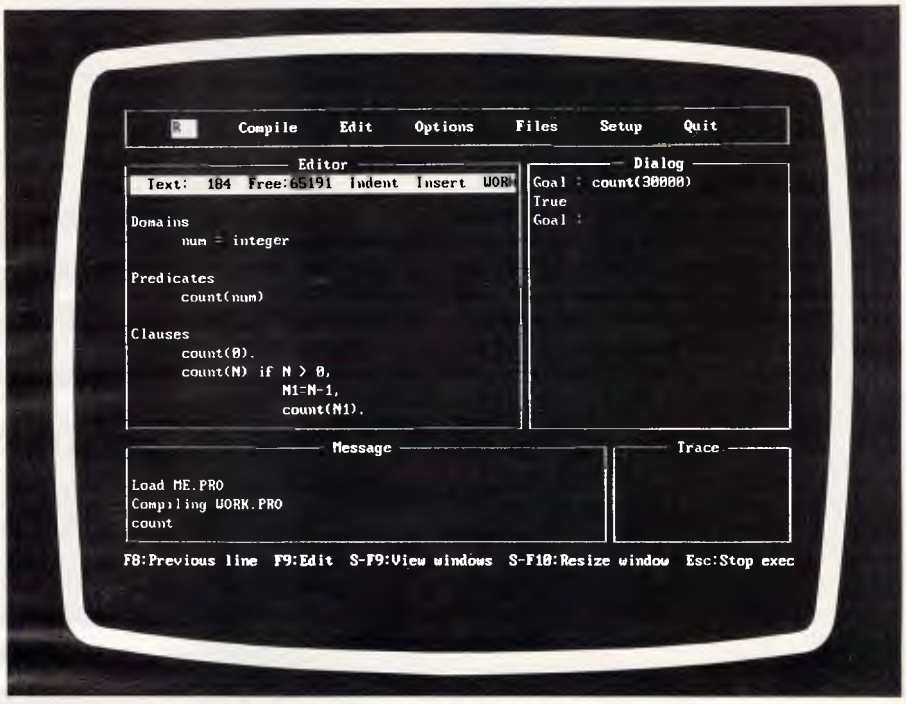

Figure two: the Turbo Prolog screen

type checking in Pascal. The knowledge base can be altered dynamically through the 'assert' and 'retract' predicates, even when compiled, and the knowledge base can be saved to disk. Turbo distinguishes between the fixed portion and the dynamic portions of the database. One of the only restrictions found in Turbo is that only facts can be altered dynamically, not rules.

In true Borland style, the language is finished well, including built-in window, sound, colour and graphics support. A BIOS interface is provided, as is an interface to execute MS-DOS commands from within Prolog programs. Full file access is provided, even random access files. The editor can be run within any program, either in update or read-only modes. The cursor can be positioned anywhere on the screen, and individual key-strokes can be sensed. To cap it all off, a full set of turtle graphics predicates are also built in.

Language		Time
Turbo Prolog	- Integer	1.7
	- Real	25.5
	- Integer Non-optimised	3.1
Prolog 86		204.0
MicroProlog 3.1		260.0
Basic Interpreter	- Integer	49.8
	- Single	62.9
Compiled Basic	- Integer	0.3
	- Single	7.7
Turbo Pascal	- Integer	0.3
	- Real	10.2

Notes:

1. ***Run on Olivetti M24.***
2. ***MicroProlog required explicit coding for tail recursion, otherwise ran out of memory after less than 100 iterations.***
3. ***Prolog 86 ran out of memory after less than 3000 iterations even with explicit coding of tail recursion.***
4. ***With optimisation suppressed, Turbo Prolog ran out of memory after 7500 iterations.***
5. ***Other language times shown for comparison only.***
6. ***Turbo Pascal and Prolog 'Real' type is equivalent to Basic 'Double'***
7. ***Basic programs written using 'WHILE' loop.***
8. ***MicroProlog program is extremely "case" sensitive.***

Figure three: Comparitive programs and execution speeds to count to 30000

Turbo Prolog

```
Domains
      num = integer
Predicates
      count(num)
Goal
      count(30000)
Clauses
      count(0).
      count(N) if N>0 and
                  N1=N-1 and
                  count(N1).
```

Micro Prolog, native

```
((COUNT 0))
((COUNT X)(LESS 0 X)(SUM 1 Y X)(/)(COUNT Y))
? ((COUNT 30000))
```

Micro Prolog, Simple

```
add(count(0))
add(count(x) if LESS(0 x) and SUM(1 y x) and / and
    count(y))
is(count(30000)
```

Prolog 86

```
count(0)
count(X) :- X>0, Y is X-1, !, count(Y)
count(30000)
```

Figure four: Programs used for timings in Figure three

```
/*****************************************************************/
/*                      TOWERS OF HANOI                          */
/*                      ===============                          */
/*                  this hanoi is slowed down                    */

/* Call the predicate hanoi with the number of slices, you want.*/
/* Example:  Hanoi(6).                                          */
/*****************************************************************/
DOMAINS
  TIME, ROW, COL, NUMBER = INTEGER

PREDICATES
  hanoi( NUMBER )
  move(  NUMBER, NUMBER, ROW, ROW, ROW, COL, COL, COL )
  inform(  NUMBER, NUMBER, ROW, ROW, COL, COL )
  makepole( NUMBER, NUMBER, COL)
  delay()  dd(TIME)
  move_vert(COL,NUMBER,ROW,ROW)
  move_horizon(ROW,NUMBER,COL,COL)

CLAUSES
  delay :- dd(100).
  dd(0):-!.
  dd(N):-N1=N-1,dd(N1).

  hanoi(N) :-
        N<=13,!,
        VB=2+6*N,VH=3+N,CV=N, CM=3*N, CH=5*N,
        STCOL=(79-6*N)/2, STROW=(25-VH)/2,
        makewindow(1,7,7,"Hanoi",STROW,STCOL,VH,VB),
        makepole(N,N,CV),
        move(N,N,0,0,0,CV,CM,CH),
        cursor(0,0), write("Press any key"),readchar(_).

  hanoi(_):- write("maximum 13 disc's\n").

  move(H,1,HA,_,HC,CA,_,CH):-!,inform(H,1,HA,HC,CA,CH).
  move(H,N,HA,HB,HC,CA,CB,CC):-
                N1=N-1,
                HA1=HA+1,
                move(H,N1,HA1,HC,HB,CA,CC,CB),
                inform(H,N,HA,HC,CA,CC),
                HC1=HC+1,
                move(H,N1,HB,HA,HC1,CB,CA,CC).

 inform( H, N, H1, H2, C1, C2 ) :-
        C11=C1-N, C22=C2-N, NN=2*N,
        H11=H-H1, H22=H-H2,
        move_vert(C11,NN,H11,1),
        move_horizon(1,NN,C11,C22),
        move_vert(C22,NN,1,H22).


  makepole(_,0,_):-!.
  makepole(H,N,C):-HH=H-N,inform(H,N,HH,HH,C,C), N1=N-1,
        makepole(H,N1,C).

  move_vert(_,_,H,H):-!.
  move_vert(COL,SIZE,H1,H2):-H1<H2,!, /* move up */
        H11=H1+1,
        field_attr(H11,COL,SIZE,112),
        field_attr(H1,COL,SIZE,7),delay,delay,
        move_vert(COL,SIZE,H11,H2).
  move_vert(COL,SIZE,H1,H2):-H1>H2,!, /* move down */
        H11=H1-1,
        field_attr(H11,COL,SIZE,112),
        field_attr(H1,COL,SIZE,7),delay,delay,
        move_vert(COL,SIZE,H11,H2).

  move_horizon(_,_,H,H):-!.
  move_horizon(ROW,SIZE,C1,C2):-C1<C2,!, /* move right */
        C11=C1+1, HH=C1+SIZE,
        field_attr(ROW,HH,1,112),
        field_attr(ROW,C1,1,7),delay,
        move_horizon(ROW,SIZE,C11,C2).
  move_horizon(ROW,SIZE,C1,C2):-C1>C2,!, /* move left */
        C11=C1-1, HH=C11+SIZE,
        field_attr(ROW,C11,1,112),
        field_attr(ROW,HH,1,7),delay,
        move_horizon(ROW,SIZE,C11,C2).

goal
  hanoi(6).
```

Listing one: Sample Turbo Prolog Program to solve the "Towers of Hanoi" problem

Basically, anything you would expect to find in any decent language will also be found within Turbo. Compare this to the older Prologs which were really bare bones systems — good for educational training, but really not well suited to building systems.

Turbo Prolog also automatically detects 'tail recursion' situations, and transparently removes the recursive aspect to end up with a simple iteration. As you can see from the timings in figure three, even when you fool it into missing this optimisation, it still outruns everything else.

Documentation

The manual is 220 pages and is well written. The first half is a tutorial section, designed for newcomers to the world of Prolog. The second half is the reference. More than 60 full examples are provided in the manual, each of which appears on a supplementary program disk. This means that you can run the examples and experiment without the hassle of typing them all in. Additionally, a complete application called 'Geobase' is provided. This is a database about American geography, including states, rivers, cities and populations. Front-ending Geobase is a natural language system. It's not the best I've seen, but enough to demonstrate how easy it is to do language parsing in Turbo. You've just got to look at Geobase to see what a high quality end product Turbo is capable of delivering — pop up 'Mac' style menus and all.

Other examples provided with Turbo illustrate a simple arcade game and a knowledge based system (the traditional "what animal am I?" system).

Although the manual does quite a good job of the tutorial, other standard introductions to Prolog may be useful. The manual isn't strong on techniques, for example, there is no mention of how to sort. Likewise, lengthy sections on how to build full expert systems and how to perform language parsing could have been useful. In fairness, putting all this in would have cluttered the manual unnecessarily. Any number of good books will show you how to write a compiler or language converter in Prolog.

These things aren't as difficult as they sound, either. In many ways, it's easier to write a language converter or expert system in Prolog than it would be to write an accounting system. For example, someone in the States has already used Turbo Prolog to build a converter from Basic to C under Unix for an all-up cost of $7,500. It's likely that Turbo will be the basis for many natural language front-ends and analytical back-ends for some of the favourite database systems.

Turbo even provides support for the COM port, and although this support is not as full as required for some applications, access to INT 14 through the BIOS predicate allows as much control as required. It should be interesting to see what uses of Prolog can be made in the communications area.

Turbo Prolog requires an IBM PC or compatible running MS-DOS or PC-DOS version 2.0 or later, and needs 384k of RAM. It comes on two disks, only one of which is required to get the product up and running.

Conclusion

Well, it's been a rave review. In a time when we're seeing "yet another spreadsheet", "yet another PC/AT clone", "yet another 4GL" and so on, it's refreshing to come across something to which the word 'new' really can apply.

Turbo Prolog costs about the same as Turbo Pascal, and no doubt the same discounting war will apply. For the sake of your future in the computing industry, to remember how a newcomer to computing feels, or just for a breath of fresh air, get yourself a copy. It's worth it.

END

APC SPECIAL REPORT

PC lap-helds

It's a fact of life that IBM compatibility extends to all areas of computer design and manufacture, the portable/lap-held corner included. Three of the new-style lap-helds, the Toshiba 3100, the Olivetti M22 and the Chendai Lap, aim to provide true desk-top power any time, anywhere.
Nick Walker and Ian Davies road test these small wonders.

Life as a hardware designer for a company which manufactures IBM-compatibles must be very dreary. Despite all the new, exciting chips, machines still have to be designed to conform to the IBM PC standard. Considering these restraints, it's amazing just how much progress has been made: current PC-compatibles are faster and much smaller than the original system.

The Toshiba 3100: PC/AT power in a portable box

In recent months, a number of new lap-helds have been launched, and unlike previous lap-helds, these new machines are true competition for the best desk-top micros. In this Benchtest, I'll take a look at three of these lap-helds — the Olivetti M22, the Toshiba 3100, and the Chendai Lap.

Toshiba 3100

Hardware

The Toshiba 3100 looks like a very classy machine. The outer casing is dark grey with stylised ribbing, and features a large, prominent hinge which adds to rather than detracts from the design. The overall effect is certainly stylish, but is perhaps too futuristic for some tastes. The label 'T3100' appears on the lid in bright orange letters, giving a clue to the colour scheme and screen colours within the box.

A carrying handle pulls down from the rear of the machine so that just the micro can be carried, or if you have extras to transport, a case with both hand and shoulder straps is supplied. The 3100 will, at a pinch, fit inside an ordinary briefcase — something which the manufacturers of earlier, less powerful lap-helds thought essential, but which has recently been dropped as a design objective.

A clip at the front of the machine is pressed to release the lid, which hinges back to form the screen in usual lap-held fashion. Unlike other lap-helds, however, the hinge doesn't run the full width of the machine, but creates what sci-fi buffs

might call a 'pod'. The 3100's good looks continue with the keyboard, which is two-tone grey with some keys labelled in amber/orange. The hinge contains seven LEDs, and the amber screen occupies most of the lid.

Around the edge of the machine, to the right, is an opening into which 3.5in disks can be inserted into the floppy disk drive. The rear of the machine features: an RS232 serial port, unfortunately of the less standard nine-pin D type; a Centronics parallel printer port which doubles as an external floppy disk drive port; an RGB port configured to the IBM standard for RGB monitors; a socket for the insertion of expansion cards (IBM expansion card format, but a quarter of the size); and a socket for the connection of a standard three-pin power cable.

The right-hand side of the 3100 is bare except for a three-position switch labelled 'PRT, A and B'. This allows you to select whichever device is attached to the parallel port — either the printer, external disk drive A or external disk drive B. By attaching Toshiba's optional 5.25in floppy disk drive and making it drive A, you can run the few items of copy-protected software which require the original 5.25in master disk to be in drive A.

The 3100's processor is a CMOS version of Intel's 16-bit 80286 (iAPX 286), the first low-powered CMOS version of this chip I've seen in a production computer. In some respects, this processor makes the 3100 an IBM PC/AT clone, though I doubt that the 3100 would be used as the centre of a small multi-user system, so in reality it is a high-performance IBM PC. This CMOS processor is normally driven at 7.74MHz, which is faster than both the PC and the PC/AT. For applications which are time-critical, a software switch allows you to run the processor at 4.77MHz.

The 3100 contains 640k RAM, which is the maximum a PC-compatible can address without resorting to convoluted schemes such as Intel's Above Board. I've always considered it sensible for manufacturers of lap-helds to put as much RAM as possible within the machine, as there is generally little room for expansion, so it's nice to see that Toshiba has done so. The RAM is also of the low-powered CMOS kind although it makes no attempt to maintain its contents when the power is turned off, except for the few bytes needed to maintain a real-time clock/calendar.

It is interesting to note the use of CMOS circuitry throughout when the machine has no option for battery power — perhaps a battery-powered version is in the pipeline. As it stands, the 3100 has an internal power supply (no bulky extra box), and a switch at the rear lets you select either a 220V or a 110V power supply — useful if you are travelling abroad.

Mass storage comes in two forms: an internal 720k, 3.5in floppy disk drive; and, surprisingly, a 10Mbyte Winchester hard disk. The reason this is surprising is not that the 3100 contains a hard disk, but that the micro seems too small and light to be able to hold anything so substantial. The hard disk itself is a 3.5in JVC affair, as found on some of the 'disk on a card' boards which are currently so popular for desk-top PCs. In use, both disk drives work well and are reasonably fast. One consideration for anyone putting a hard disk into a lap-held is ensuring that it can take the knocks which come from transportation. The Toshiba/JVC hard disk is tested to withstand a 70G force, which covers most knocks the system is likely to have.

Opening up the 3100 is a simple job, considering that most lap-held manufacturers don't want you to get anywhere near that supposedly delicate CMOS circuitry. Eight Phillips screws are removed and the top lifts off easily. Most of the chips are at the front of the machine, under the keyboard; the hard disk is on the left-hand side; the floppy disk is on the right-hand side, mid-way down the PCB; and the power supply is particularly impressive, being noticeably smaller and lighter than any I've seen on similar machines. A tunnel under the power supply allows the insertion of an expansion card. A tiny fan at the rear cools the entire board; this fan is almost silent, but is audible in a quiet room.

It is obvious that considerable work has gone into the PCB's design. Five custom CMOS gate arrays have been designed for bus control, the bus driver, DMA control, I/O control, and display control. Surface-mounted technology, combined with the CMOS custom chips, results in an IBM PC/AT-compatible with 640k RAM, a colour display adaptor, and a serial and parallel port adaptor occupying less space than a single, IBM, long expansion card. The board is, in general, of a very high quality and has no obvious patches.

The most significant aspect of the 3100 is its use of a gas plasma display. A lot of criticism has been levelled at the displays of lap-held micros. Ideally, a lap-held's display should give all the advantages of a CRT (cathode ray tube), such as colour graphics and illumination, and yet be small, light and low-powered. The most common approach is to use an LCD (liquid crystal display) which *is* small, light and low-powered, but LCDs can be abysmal in certain lighting conditions, and, at the moment, can only simulate colour graphics with limited grey scaling. A second, less common approach is to use gas plasma, which overcomes the readability problems of LCDs, is small and light, but which consumes almost as much power as a CRT and offers even less in the grey-scaled simulated colour graphics stakes.

Given that the 3100 needs mains power to drive its hard disk, the inclusion of a plasma screen presents no undue problems. The display is amber on brown and gives far better readability than an LCD, but compared with other gas plasma displays, such as the Grid's amber on black, it offers slightly less clarity. The machine's lack of contrast on a gas plasma screen notwithstanding, the 3100 makes an excellent attempt at colour graphics — once again, far better than that of an LCD.

The screen usually acts as an IBM colour monitor, with 80 characters by 25 lines, as far as most software is concerned. However, in terms of pixel

Technical specifications: Toshiba 3100

Processor:	80286 running at 7.74MHz, switchable to 4.77MHz
ROM:	32k
RAM:	640k expandable to 2.6Mbytes internally
Mass storage:	Internal 10Mbyte hard disk and 720k, 3.5in floppy; optional external 360k, 5.25in floppy
Keyboard:	81 keys, full-travel
Size:	30cm X 8cm X 36cm
Weight:	6.6kg
I/O:	Expansion port, RS232C serial port, parallel printer/ external FDD port, clock/calendar, RGB port
DOS:	MS-DOS 2.11
Bundled software:	None
Peripherals:	I/O expansion bus card, expansion module, 5.25in external floppy disk drive, internal 300/1200 modem, internal 2Mbyte memory expansion card
Power:	240V or 110V mains

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resolution, the 3100's screen is twice that of the IBM, at 640 x 400. 640 x 200 simulation is the norm, but the machine's double-resolution vertical means that a lot more pixels are available for the character set, so the characters are nicely defined.

The screen can be angled to between 90 degrees upright to 135 degrees tilted back. I have slight reservations about the infinite number of positions which the display can rest in, as other lap-helds which use this method have worn in such a way that the display can only lie back. Time will tell if this is to be the case with the 3100. When the lid is closed but the machine is still switched on, the display switches itself off and curiously lets out a quiet hiss as it does so. I have always thought that gas plasma displays are sealed units, so unfortunately I don't know where the hiss comes from.

The keyboard is an 81-key, full-stroke affair, so some effort has gone into squeezing it down from the PC/AT's standard 103-key unit. The main qwerty area consists of 48 keys which occupy the centre of the keyboard, and is coloured light grey with white lettering. All the other keys are function or control keys, lettered in a tasteful gold/orange on dark grey keys. The numeric keypad has been overlaid on the right-hand side of the qwerty area and is selected by the Num Lock key. The top row of keys contains, from left to right: Esc, in the top left-hand corner where it should be; the 10 function keys; Num Lock; Scroll Lock; Prt Sc; and Sys Req. Other important control keys such as a cursor cluster, PgUp, PgDn, Home and End have been placed on the right-hand side of the keyboard.

Overall, Toshiba has done an excellent job — the keyboard is easy to use with a good positive feel, though regular users of the numeric keypad may not agree. The machine can be tilted by adjusting the carrying handle, thus angling the keyboard for touch-typing.

There are seven LEDs on the hinge which illuminate to signify power/processor speed, hard disk access, floppy disk access, RGB connected, Caps Lock, Num Lock and Scroll Lock. The processor's LED has nifty dual colours, with red signifying slow and green signifying fast. Interestingly, you can switch between speeds on the fly without a software crash (Ctrl Alt PgDn to select the slow processor speed, and Ctrl Alt PgUp to select the fast processor speed).

A number of hardware extras are offered for the 3100. At the time of writing, these are: an internal modem card; an expansion box which will take up to five PC or AT expansion cards; an expanded memory card; and an external 5.25in disk drive. None of these items were supplied with the review machine, but they should be available by the time the machine becomes available in September.

The well-engineered and truly compact 3100 is ideal for business travel

System software

Further proof that the 3100 is more of a high-performance IBM PC clone than a PC/AT clone is given by the use of MS-DOS 2.11 rather than the more usual MS-DOS 3.1 (used with the PC/AT). The MS-DOS included with the 3100 is standard, and has no interesting little extras.

A sign of how much research has gone into the 3100 can be gleaned from the fact that the ROM-based BIOS routines have been developed in-house. The usual route for clone manufacturers is to buy in a ROM BIOS, which says something about Toshiba's level of commitment that it hasn't followed suit.

Some effort has gone into compensating for the lack of contrast on the plasma screen in the form of a program called Chad, which allows you to configure the screen to the extent of reversing its colours (dark brown on amber instead of amber on dark brown), and also allows you to use an alternative character set to signify text in different colours. One particularly nice thing about Chad is that it runs in the same way as Sidekick: having run Chad, you just press Sys Req and a window pops up, allowing you to configure the screen. You can actually see the screen you want to change while you are working on it.

Applications software

As the 3100 is IBM-compatible, there is an enormous range of applications software available for it, though there

Benchmarks: Toshiba 3100

BM1	0.7
BM2	1.5
BM3	4.6
BM4	3.7
BM5	3.9
BM6	6.5
BM7	13.9
BM8	13.8
Average	5.4

All timings in seconds.
For a full listing of the Benchmark programs, see End Zone.

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may be some difficulty transferring certain copy-protected software to this format. However, the recent announcement by IBM of its own lap-held which uses the 720k, 3.5in disk drive is already forcing a drastic increase in suitable software.

Like all recent IBM-compatibles, the 3100 has a high level of compatibility with IBM software. I used to enjoy taking a vast collection of disks along to clone manufacturers to find any incompatibility, but there's no longer any fun in it. The only packages I couldn't run on the 3100 were a couple of peculiar public domain games. Practically all applications will run on the 3100, and all the ones I tried will work at the higher processor speed. If timing is a critical factor, you can slow down the processor.

Documentation

Three manuals will be available: *Owners Manual, MS-DOS V2 Reference Manual* and a *Basic Manual.* At the time of writing this review, no decision had been made as to which manual(s) will be supplied with the machine.

The Olivetti M22 has a superior screen and big-company backing

Olivetti M22

Hardware

The Olivetti M22 is a true, hybrid luggable/lap-held. Certainly, it is a hefty box to have perched on your lap in the normal manner, and it will not fit inside an average briefcase. Olivetti supplies a shoulder-strapped carrying bag which has room for any extras you may want to transport, and a carrying handle pulls from the rear of the machine if you want to carry it alone. The plastic casing is finished in the corporate colours of light blue and grey. When closed, the M22 looks like a bulky, uninteresting grey box which is more likely to contain a mass of stationery than a computer.

In usual lap-held fashion, the screen rests on the keyboard when the unit is closed, and hinges back when it's in use. Inside,the keyboard continues the blue and grey theme, with blue letters on grey keys, and a large, green-looking LCD occupies the unusually thick lid.

The right-hand side of the casing features the 5.25in floppy disk drive housing. At the rear is an RS232C serial port, a parallel Centronics printer port, a mouse port for Olivetti's own mouse, and a socket for power-in. The right-hand side of the machine is bare except for one huge, ugly hole whose purpose I'll describe in due course.

The M22 contains two CMOS 8088 processors, both running at 4.77MHz. One of these processors is the main processor; the second processor's sole purpose is to manage a built-in concurrent piece of software called Personal Windows. Considering Olivetti's expertise in manufacturing high-speed processors, such as the one in the M24 desk-top machine, I was particularly disappointed to see that the company has opted for an 8/16-bit processor running at 4.77MHz, which is what IBM used on its original IBM PC. For the base-level entry machine, the M22 is supplied with 256k as standard, and can be expanded up to 1Mbyte internally.

The M22 has battery power, something you wouldn't normally expect on a machine of this bulk and specification. Power can be supplied by a rechargeable battery pack which gives approximately eight hours continual use — provided you don't do anything excessively power-hungry. Alternatively, 10 alkaline batteries will provide approximately 16 hours of use. Olivetti provides a power supply which also recharges the battery. This is an interesting unit which you can plug into any mains supply in any country, and it will still provide current to the machine. The fact that it's external, however, does add extra bulk to the system.

Mass storage is provided by a half-height, 360k, 5.25in disk unit which is fast and quiet. Further storage can be provided by an optional 10Mbyte Winchester, but as this occupies the battery compartment space, there is no way in which you could use battery power, even if the hard disk were sufficiently low-powered to cope with it.

It wasn't until I tried to open the machine that I discovered the purpose of the large, gaping hole on the left-hand side of the machine. A panel runs across the top of the top of the M22's rear, and this hinges up to reveal an expanse of fresh air; if you look carefully, an edge connector can be found in the lower left-hand corner. This space has been designed to take a standard full-length card, and the gaping hole on the right-hand side means that any ports available

The M22: 'a true luggable/lap-held'

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from this card will still be available when installed on the M22. As far as I know, this is a unique feature among PC lap-helds, and one that may sell a number of Olivetti M22s into specialist markets. There are two more expansion slots running under this area, which takes Olivetti's own customised expansion cards. All M22s have a serial card in one of these slots, which forms the serial port on the back of the machine.

Getting inside the Olivetti can be quite an experience — not because it is particularly difficult, but because unless you know where to look, you won't find any trace of a processor, or RAM, or even a PCB. The main PCB is neatly tucked away behind the screen, although when you have discovered its hiding place, it is relatively easy to get to. Once inside, you will discover an impressively small PCB, considering that it contains two 8088 processors, 1Mbyte of RAM, and custom chips for display and DMA (direct memory access).

The M22's screen is the best example of back-lit LCD technology I've seen on a lap-held, offering greater contrast and much better clarity than any similar display. The colours do take a bit of getting used to, and the slow refresh rate gives a slightly disturbing fluid-like effect. The overall effect is of a clear, readable screen, but the fluid, characters resemble a schoolboy's smudged exercise book. Two controls enable you to customise the display to suit the lighting conditions: a contrast slider bar at the top right-hand corner of the keyboad; and six back-light settings. The screen operates as an 80 x 25 character, 640 x 200 pixel IBM colour monitor, and truly gives a better level of scaling for graphics.

The screen will angle anywhere between 30 to 180 degrees, and like so many latter-day lap-helds, it uses a hinge which allows you to position the screen anywhere in this range. I am unconvinced about the reliability of this hinge in the long-term, though.

The keyboard has 85 keys, and, considering this is 18 keys less than the IBM PC's keyboard, I encountered no problems in converting from the IBM keyboard. The usual problems of the IBM keyboard, such as the placing of the reverse oblique key and the diminutive Enter key, have been rectified, and, unusually on a portable, there is a full numeric keypad. The keyboard has an excellent feel, and the required typing angle is obtained by folding the carrying handle underneath the keyboard. The function keys are half size and run along the top of the machine, so there is no place for a function key overlay. The Num Lock, Scroll Lock and Caps Lock keys are above the numeric keypad, and contain an orange LED to indicate when they are engaged. Four more LEDs are at the right of the keyboard: power; floppy disk access; RAM disk access; and the fourth LED, although unmarked, lights up when the optional internal modem is receiving data.

Extras for the M22 include an internal modem card, a 10Mbyte hard disk, RAM expansion, and a mouse, but none of these were available at the time of writing.

'With the inclusion of a hard disk, any one of these machines could be used as a real alternative to a desk-top PC...'

System software

An IBM clone cannot be producd without the use of a version of MS-DOS as the operating system. The M22 is no exception, and uses the standard operating system among machines which are trying to be PC-compatible rather than PC/AT compatible — MS-DOS 2.11.

Much more interesting than MS-DOS 2.11 is the Personal Windows software which resides within a 32k ROM and operates on the second 8088 processor, making it truly concurrent. Personal Windows has been inspired by Borland's Sidekick. Sidekick is a set of 'desk accessories' which lie dormant in RAM until a certain keystroke combination brings them to life, regardless of the application which is being run. Like Sidekick, Personal Windows contains a memo pad, an address book and an appointment book. Unlike Sidekick, there is a powerful system configuration and a RAM disk. As Personal Windows runs on a separate processor from any application you may be running, that application carries on with its job — printing, recalculating a spreadsheet, or whatever.

From the system configuration screen, you can customise a vast number of options which are grouped in five categories: System; Printer; Initialisation; Calculation; and Personal Windows Applications. All the options are useful and replace not only some complex DOS operations, but also, in some cases, DIP switch settings. One particularly nice option is the ability to switch off the power to any of the three expansion boards, thereby saving a substantial amount of power when the battery is in use.

The way in which Personal Windows operates on the M22's second processor is worth some explanation. The first processor writes to the area of RAM that is usually reserved for the screen; the second processor then takes this RAM and transfers it to the actual screen memory, which is part of the second processor's memory map. Consequently, Personal Windows can put up information anywhere onscreen without upsetting in any way the application which is being run.

Apart from the video RAM and the Personal Windows ROM, the rest of the second processor's RAM is set aside for the RAM disk. I've never been a great fan of RAM disks — all that data sitting volatile in RAM worries me. Olivetti does offer some protection, in that power to the system is maintained for 15 seconds after power-off, and the RAM disk access light flashes if data is still in there. During this 15 seconds, the Personal

Technical specifications: Olivetti M22

Processor:	Two 8088s running at 4.77MHz
ROM:	96k
RAM:	256k
Mass storage:	One 5.25in, 360k floppy disk drive; optional 10Mbyte hard disk
Keyboard:	85-key full-stroke
Size:	40cm X 9cm X 34cm
Weight:	7.4kg
I/O:	RS232 serial interface, parallel Centronics interface, mouse interface, one PC-standard expansion slot, two custom Olivetti expansion slots
DOS:	MS-DOS 2.11
Bundled software:	Personal Windows in ROM
Peripherals:	Various memory boards, mouse, rechargeable battery pack, 10Mbyte hard disk
Power:	10 ordinary alkaline batteries, rechargeable battery pack, any mains voltage

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Windows data (that is, the appointment book, the memo, the telephone list, and so on) is saved to an area of CMOS memory which is maintained while the machine is switched off. Even considering these safeguards, I would only use the RAM disk to simulate a drive B for software which needs two drives. Perhaps I'm just old-fashioned.

Applications software

There are no problems with compatibility on the M22: everything I tested ran satisfactorily, and as the machine takes a 5.25in disk, you can plug in one of the thousands of applications available for the IBM PC and use it immediately. Some of the applications which use colour graphics are a little disappointing under Olivetti's grey scaling, but apparently there will be some improvement in the final production machines.

Documentation

Olivetti appears to have standardised its documentation to one 100-page manual, which covers all you'll need to know but not in great depth. For beginners, there's a tutorial disk to introduce you to the system.

Benchmarks: Olivetti M22

BM1	1.2
BM2	4.6
BM3	10.1
BM4	10.7
BM5	11.7
BM6	21.1
BM7	32.9
BM8	34.5
Average	15.8

All timings in seconds.
For a full listing of the Benchmark programs, see End Zone.

Chendai Lap

Hardware

Although the Chendai Lap is not much smaller than the Olivetti M22, it can just about be called lap-held, whereas the M22 is really at the bottom of the portable class. The Chendai's casing is in light grey plastic, and the overall impression is one of remarkable ordinariness: the Chendai is a kind of heavyweight Tandy 100.

The Chendai Lap just qualifies to be called portable and lap-held

There is no carrying handle, so the only way to transport the machine is via the rather stylish bag which has shoulder straps and a carrying handle. As for the briefcase test, the M22 did just fit, although I don't think the briefcase would last long.

Two catches on the side of the machine are pulled forward to release the lid, which folds to reveal the screen on its inner surface. Inside, there is a keyboard in the same shades of grey as IBM uses on its PC, and a screen which occupies two thirds of the width of the unit.

To the right of the machine is the opening for the 5.25in floppy disk drive, and an obnoxious bulge which houses a fan to cool down the hard disk. At the rear, the Chendai has five ports: an RS232C; a Centronics parallel printer output; a 96-way expansion port; an RGB output configured for IBM's standard plug; and a composite monitor output. Also on the rear is a switch to select either the Chendai's own screen or an external monitor. The right-hand side of the casing contains a standard, three-pin power input and a 110V/220V voltage selector.

The bulge on the side of the Chendai houses the system's fan

The Chendai uses an 80186 processor which is Intel's slightly extended, faster version of the 8086 true 16-bit processor. Chendai is driving this chip at only 4.915 MHz, which is not a great deal faster than the 4.77MHz used by the IBM PC. Processing 16 bits at a time rather than eight does help, but it still isn't particularly fast. This chip has been unpopular in the past with PC clone manufacturers, as it takes a lot of effort to bring it up to a high level of compatibility.

RAM on the standard machine is 256k, expandable to the PC's full sensible address range of 640k internally.

Mass storage is provided by a 5.25in floppy disk drive and a 3.5in Winchester drive. The 5.25in floppy is half-height, and gives the usual 360k of storage on a single, double-density, double-sided disk. The Chendai has the distinction of being the first lap-held available in Australia to have an internal hard disk, and, what's more, the disk size is not 10 but 20Mbytes — a lot of storage for a small box.

Internally, the Chendai's power sits at the rear — from left to right there is: the power supply; the processor and its accompanying chips; and the two hefty-looking disk drives. The PCB in the middle looks well-organised and engineered, if somewhat ordinary. Like most compatibles, there is a rather large custom chip which mimics the function of the colour graphics adaptor in the PC

Lapping up the take-aways

Martin Banks considers the future of laptops in the wake of the US Internal Revenue Service's choice of the Zenith Z-171.

Sometimes these things seem to happen as if by spite. There they were, the assembled multitude of the world's computer press, the IBM watchers and experts, all waiting for the US Internal Revenue Service to do the proper thing and order a laptop personal computer from IBM.

Once this had happened, the rest of the industry could copy the laptop and users would feel confident that the need for such a machine existed. They would, it was confidently expected, buy the things in horrendously large volumes.

Then there was one of those spiteful business decisions that throw a not inconsiderable spanner in the works. The Internal Revenue Service didn't order a laptop from IBM. Instead, it went and ordered one from Zenith.

This has blown a largish hole in the prognostications. Not only is the industry less likely to rapidly clone IBM's new machine, but the decision also changes (or more specifically doesn't change) the way the laptop market is expected to develop in a post-IBM-wins-IRS-order world.

As IBM is a company that spends more on research and development than many countries, it was not too surprising to learn some time ago that it was playing around with the laptop portable computer idea. It can be safely assumed that IBM has made at least one of anything anyone has ever thought of under the title 'computer'.

It was even less surprising that the system had an internal project name: Clamshell. What is slightly more surprising, and certainly interesting, is the specification of the Convertible that has now emerged from the company. The most interesting bit is the selection of 3.5in floppy disks as the storage medium.

This has caused much speculation, not least because it represents a step out of line from the PC family's 5.25in disks. The big question becomes obvious: how much of a change will this mean to the PC family as it develops in the future? Will 5.25in disks be dropped in favour of 3.5in units in the then expected PC2? Will we all have to buy add-on disk drives to remain compatible?

As far as its effect on the laptop market goes, well so far laptops have not been the most successful of variations on the personal computer theme. Despite being an excellent theory — pack a PC into something carried around easily and capable of working from batteries — it has not been accepted as a practical option by the majority of users. There are a number of reasons for this, connected to money and applicability.

Taking money first, the main objection has been the poor cost benefits that such systems provide. Low-cost machines like the Tandy and NEC do what they do very well. It is just that they are really only good for electronic note-taking and similar writing duties. Their small memories and small displays are unsuitable for the type of large-scale work in which a PC user regularly indulges.

Systems capable of handling this type of work, such as those from Hewlett Packard, Ericsson and Data General are, to put not too fine a point on it, expensive. And while Toshiba, for example, has brought out cheaper systems, the company lacks the marketing clout to really make the laptop a general-purpose machine.

Instead, these machines are being sold into specialised vertical markets where their capabilities make an economic trade-off against their cost. Typical applications are travelling sales staff and engineers working on some remote site. We can now, of course, add to that list the American travelling tax collector, of which the IRS has 15,000 if the size of the Zenith order is any indication.

So there are areas where such machines can make a great deal of sense. Many applications like the above warrant having a computer around at some location where a normal desktop PC would be inappropriate, or just plain unusable. Then, their cost is of secondary importance. Indeed to many of these potential customers, paying $6000 or $8000 per box can very often make extremely good economic sense.

To the average punters who just feel it would be a good idea if they had a machine they could take around with them, the difference in that price, the $US1,995 price of the Convertible and the $US1500 or less of some PC clones becomes an unanswerable argument.

This relegates laptops for a while to those specialist vertical markets where they have some leeway not only on pricing but also on technical matters. For example, some of the suppliers have already opted for 3.5in disk drives, while others have gone for full IBM compatibility.

But just imagine what the result might have been if IBM had won the order.

Every manufacturer of a PC compatible would promptly rush out their own version of the machine, competing with IBM on the basis of price and/or technology. Some would offer a superior specification for the same price, while others would take the same technology and cut and cut until, like the PC itself, the price will continue to fall.

This will still happen to some degree, of course, but not with the same speed or impact. So the American Internal Revenue Service has not only thrown a lot of egg onto a lot of pundits' faces, it has also ruined a damned good dream. Ah well, onwards to the cold light of dawn.

(or, in the case of the Chendai, the PC's colour and monochrome adaptor cards).

The Chendai's screen is a back-lit LCD affair, so you would expect it to be noticeably better than the standard LCD. The screen supplied with the review machine was a bit of a disappointment, however, it was a pre-production model which explains why. Chendai assure me that future production models will be fitted with a new super birefringent effect (SBE) which will improve the contrast and brightness.

The Chendai's display adaptor is a full-colour display, giving a resolution of 640 × 200 pixels for graphics, and 80 × 25 characters. Graphics are fairly well represented and the Chendai doesn't suffer from the usual slow refresh problem of LCDs, but the aforementioned back-light problem means that there is insufficient contrast to do the displays justice.

The keyboard is excellent. Imagine an IBM keyboard, with all the niggling little irritations removed and the function keys laid in a line above the main qwerty panel — that's what you have on the Chendai. The important keys such as Enter, Backspace and Shift have been enlarged; the reverse oblique key has jumped over the Shift key; and there's a cluster of extra cursor keys. Other than that it is basically a PC keyboard, complete with a numeric keypad and LEDs for Num Lock and Caps Lock. The feel is excellent and the typing angle is just right. It's the best PC keyboard to be found on a lap-held.

The only hardware expansion at this stage will be an internal 300/1200-baud modem.

System software

When the Chendai is switched on, it will initially try to boot whatever it can find on the floppy disk. If this fails, it will try to boot from the hard disk. Obviously, in order for it to be compatible with the IBM PC, the operating system must be a version of the ever-popular MS-DOS operating system. In fact, the unit is shipped with Chendai's MS-DOS 3.1, the current favourite among AT, rather than PC clones.

Applications software

IBM compatibility opens up an enormous range of applications software, and the Chendai is no exception. The Chendai will run practically everything. I tried the usual collection of Lotus 1-2-3, Microsoft's Flight Simulator, GEM Desktop and its applications, Windows, Crosstalk, and others. The system suffered slightly when it came to running my collection of public domain and commercial PC-crashing games, suggesting that it is less compatible than its 8088/8086/80286 competitors. If you want to run something very obscure which uses the screen and the keyboard in peculiar ways, I suggest you see it running first.

Documentation

No documentation was available at the time of writing this review.

Prices

The Olivetti M22 with 256k RAM and no

Technical specifications: Chendai Lap

Processor:	80186 running at 4.9MHz
ROM:	24k
RAM:	640k
Mass storage:	Internal 20Mbyte hard disk; 5.25in, 360k floppy disk
Keyboard:	88-key full-stroke
Size:	39cm × 9cm × 31cm
Weight:	7.3kg
I/O:	Expansion port, RS232 serial port, Centronics parallel printer, RGB output, composite video output
DOS:	MS-DOS 3.1
Bundled software:	None
Peripherals:	300/1200 internal modem
Power:	240V or 110V mains

Benchmarks: Chendai Lap

BM1	0.9
BM2	3.7
BM3	9.8
BM4	9.8
BM5	10.5
BM6	14.7
BM7	21.3
BM8	23.1
Average	11.7

All timings in seconds.
For a full listing of the Benchmark programs, see End Zone.

hard disk, is priced at $3360. The price for the M22's optional hard disk has not yet been confirmed but is expected to retail for approximately $2000.

The Chendai Lap is priced at $4750 and the Toshiba 3100 will cost approximately $8000.

Conclusion

It sometimes upsets me that hardware design is so severely affected by the need to conform to PC compatibility, but the Toshiba 3100, the Olivetti M22 and the Chendai represent a significant advance in lap-held technology. With the inclusion of a hard disk, any one of these machines could be used as a real alternative to a desk-top PC, which is something I can't say about previous lap-helds. This may sound like marketing jargon, but I know it's true from personal experience. Having that amount of power in such a portable package does increase your personal productivity.

Writing a comparison piece forces me to make a decision as to which is the best machine, and happily there is a definite winner. The machines are all clearly aimed at one well-defined area of the market — the businessman on the move. Except for the approximate $600 price difference, very little separates the Olivetti M22 and the Chendai for the second-place slot: both are good, PC-compatible, lap-held machines, offering great power in a properly portable box. However, due to its superior screen and the backing of Olivetti, I put the M22 slightly ahead.

The clear winner, though, is the Toshiba 3100, which not only puts the power of a desk-top in a portable box, but it puts the power of the best desk-top PC/AT clones in a portable box. The screen is totally readable; the processor is an 80286 running flat-out; there's a 10Mbyte hard disk; and it's well-engineered and truly compact. The only question is: where do I find $8000?

END

In perspective

If you don't have sufficient funds to be able to afford one of these three units, there are a number of cheaper PC-compatible lap-helds with ordinary LCD screens and one floppy disk drive. My particular favourites are the Toshiba 1100 and the Kaypro 2000.

For the executive who requires a really portable package, a good display, a floppy disk and, most importantly, losts of 'posing appeal', I recommend the Grid Compass III. The only other real competitors are the Data General One and the Hewlett-Packard Integral, which now seem overpriced for what they are.

SCREENTEST

Guru

Guru is a powerful and advanced integrated data management system which provides facilities for the building and consulting of expert systems. Kathy Lang tackles its impressive facilities head-on.

It is an interesting paradox of personal computing that, as personal computers have become more and more powerful, they have increasingly come to be used for applications which are not really 'personal' at all. Many database management systems now have a wealth of features which are welcome to system developers, but are rarely used by ordinary users. Word processing is increasingly dominated by large, complex packages aimed at the 'professional' user, while many spreadsheet packages are developing in the direction of modelling systems which require programming skills to be fully exploited.

At first sight, it would seem that nowhere is this more true than in the field of expert systems. These are systems that attempt to supplement or substitute for a human expert. They incorporate a body of knowledge and reasoning, together with the tools to allow a user to explore that body of knowledge to reach desired goals. For example, a general practitioner might use an expert system to help him make more accurate diagnoses in specialist areas, thus speeding patient recovery and economising on expensive consultants' time. Such systems tend to be very expensive to set up, mainly because the process of formalising the experts' knowledge is a skilled, lengthy and labour-intensive process. And the resulting system, if it is large enough to be useful, is usually very demanding in processing power and in memory.

In view of all this, you might suppose that such an area is really only of interest to large companies, which are able to make the necessary investment to build and use expert systems. Two factors may help to make it practicable to make expert systems more widely available. Firstly, as everyone knows, the price/performance ratio for microcomputers is still improving at a great rate, with faster processors and large hard disks being in use much more widely. A particularly interesting development is the potential of the video disk for storing huge amounts of directly accessible information, as expert systems tend to use large databases which strain the capacity of the average hard disk. Secondly, and partly as a response to the improvements in hardware, there are now a growing number of packages on the market which aim to make it as easy as possible to build and use expert systems.

Most such packages have been designed from scratch to run as expert-system builders. However, many of the requirements for such products are common to other applications, and in particular to applications which handle large amounts of data. The logic required to interrogate the database is, of course, unique to expert systems; but many other requirements, such as the ability to store and retrieve many variables, to display data on the screen, to ask the user for information, to report on the results, to implement control structures to enable the user to 'navigate' round the package, are also needed in a database management system.

This common ground has been

Command	Function
Consult	Consult a rule set with reverse reasoning
Consult To Seek	Consult a rule set with reverse reasoning to seek a value for a specified variable
Consult To Test	Consult a rule set with forward reasoning to test the effect on a specified variable (which may be the goal variable)
Consult To Fire	Consult a rule set to fire a specified rule, using backward reasoning if necessary
Consult to Execute	Consult a rule set to execute a specified sequence of rules

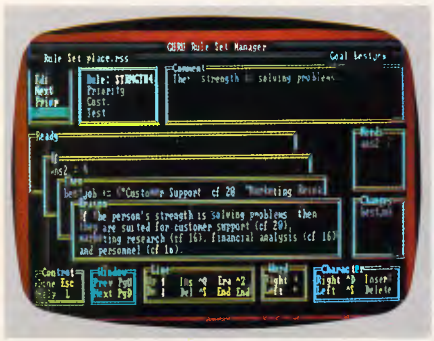
Notes: 'Reverse reasoning' involves evaluating rules for firing on the basis of finding a value for the goal. 'Forward reasoning' involves evaluating rules for firing on the basis that their premises are known

Fig 1 Strategies for consultation

Screenshot 1 Guru main menu

Screenshot 2 Model completion

Screenshot 3 Showing the goal



Screenshot 4 Constructing a rule

Screenshot 5 Defining a variable

Screenshot 6 Keeping you informed

recognised by the designers of a package which has been widely available in Australia for some years, namely Knowledgeman. Kman, as it is usually called, bears a marked similarity to the dBase family, although its database management system has some extra features beyond what is available even in dBaseIII Plus. In addition Kman 2 has a number of additional modules (for graphics, text processing, report generation, communications, and so on) that together provide a very powerful (loosely) integrated system. Onto this base, pulled together into a more integrated whole, has now been grafted a set of facilities to allow you to build and consult expert systems. The resulting package, Guru, looks very powerful indeed, though at $4278 for the full system, and requiring an IBM PC with 512k memory and 10Mbytes hard disk space, it is not for the poor or the faint-hearted.

```
GOAL:       best job

RULE:       LIKED1
IF:         ans1=1
            THEN:       bestjob += ['Accounting' cf20, 'Financial Analysis' cf
                        12, 'Data Processing' cf 12]
            NEEDS:      ans 1
            CHANGES:    bestjob
            REASON:     If the person liked accounting in college, then they
                        are suited to accounting (cf 20), financial analysis (cf
                        12), or data processing (cf 12)
            COM-        The person liked accounting in college
            MENT:
RULE:       LIKED2
            IF:         ans1=2
            THEN:       best job += ['Marketing Research' cf 18, 'Financial
                        Analysis' cf 20]
            NEEDS:      ans 1
            CHANGES:    best job
            REASON:     If the person liked quantitative methods in college,
                        they are suited to Marketing Research (cf 18) and
                        Financial Analysis (cf 20)
COMMENT:                The person liked quantitative methods in college
```

Fig 3 Example of part of a rule set

The original version of Kman was reviewed in *APC* in June 1984. The second version, Kman 2, reviewed in *APC* August 1984, was substantially enhanced, mainly by the addition of the new modules. In this review I shall, therefore, concentrate on those aspects of Guru that incorporate new features, and especially on those aspects specific to expert systems.

Like a good many parts of computing which owe their origins to computer science rather than to data processing, the field of expert systems abounds in abstruse concepts, as well as the more usual unfathomable jargon. By way of example, lay your tongue, never mind your mind, to fuzzy variables, set theory, firing (no, that's not what it means), confidence factors, backward reasoning, rule sets, and the probability sum of products. In order to understand what Guru does and how, you need a smattering of understanding of some of these ideas. If you have that understanding, or more, already, then you will need lots of detail about the guts of Guru; if you don't, then those same details will, most likely, overwhelm you. In the text I'll stick to using as little jargon and complexity as possible, at the risk of missing out on the details.

There are three ways in which the user can instruct Guru: through menus; by entering into a limited 'natural language' dialogue with the package; or by going

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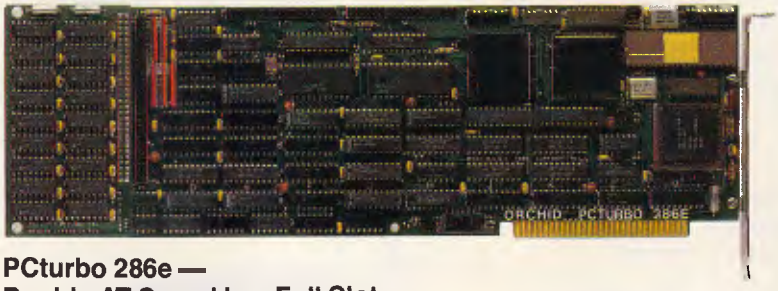

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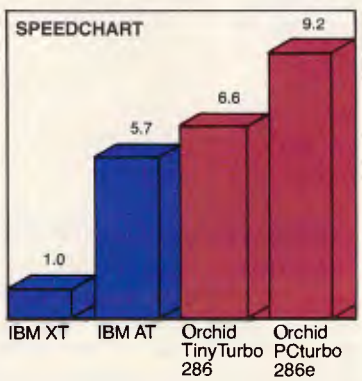

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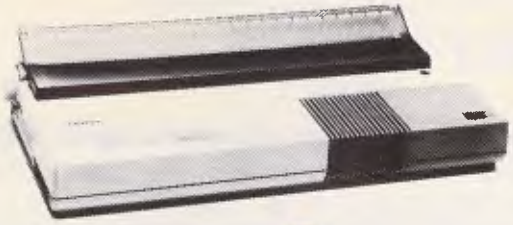

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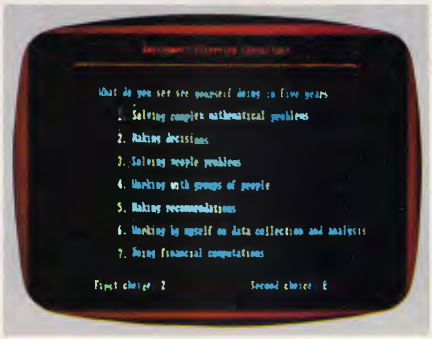
into command mode and either entering commands direct from the keyboard, or running stored commands. The menu-driven front end is very comprehensive, and I'll describe the package mainly in those terms. Guru's main menu is shown in Screenshot 1. Menus are 'stacked' as you invoke options in succeeding sub-menus; there is also plenty of screen prompting. To choose menu options, you have three choices: use the cursor keys; enter enough characters to identify an option uniquely; or use a mouse — Guru comes set up to use a mouse if you make sure that the mouse driver software is installed correctly.

Building a system

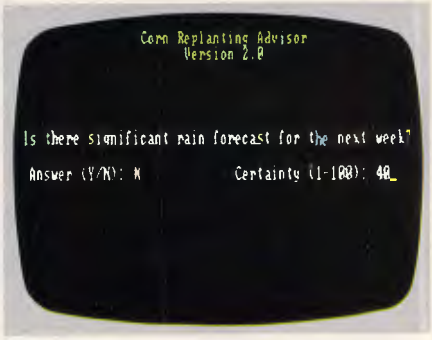
There are two basic elements to Guru's expert system facilities: build a system; and consult a system. For each, there is a Guru command, or you can invoke the option through the expert system's menu. Building a system consists of enabling Guru to construct a file of the required command, data and data references. This can be done either by responding to menu prompts, or by entering the elements of the model in a text file using Guru's own Build editor, the built-in text processor K Text, or an external word processor. When the file has been created, it must be compiled (using the Compile command); this is intended to improve the speed with which Guru systems can be consulted by users through the Consult command. (The term 'model' is used here to describe a collection of data and rules about that data. Guru uses 'rule set' instead, but as it actually comprises more than just a set of rules, I find that rather confusing.)

Compilation is quite a slow process, but I didn't notice any problems with speed when consulting the small models I used. However, for those who want to build sizeable models, it is important to check on speed of execution, and also on the model size, that is possible on your computer system. Guru does not itself limit the size of model, in that there is no restriction on the number of rules and variables in a rule set, but hardware may do so.

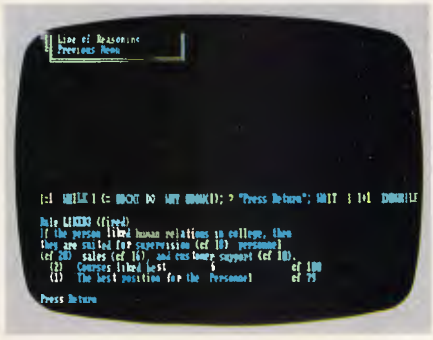
The model constructed during the Build phase, and stored in a plain text file, has several elements. The goal of the model must be defined. This goal is usually a single variable, or a so-called 'fuzzy' variable, which is a many-valued variable having certainty factors attached to each potential value. The other essential element in the model is a set of rules, which, when evaluated, will provide a value (or values) for the goal.



Screenshot 7 Querying the user



Screenshot 8 Uncertainty in Input



Screenshot 9 The line of reasoning

Screenshot 10 DBMS: menus & help

The simplest kind of model you could devise might look like this:

GOAL: Intrate
RULE: Rule 1
IF: Period <90
THEN: LET Intrate=12.5
RULE: Rule 2
IF: Monthpay <50
THEN: LET Period=120

Supposing that the variable Monthpay were initially set to 42, and this very simple model were compiled and then executed in a 'consultation'. Guru would look first for a rule that contained a definition of the goal variable — in this case, Rule 1. But this rule cannot be 'fired' or activated, because at this stage, the value of Period is unknown. Guru sets as its next task, or sub-goal, the finding of a value for Period. Rule 2 provides this, and its premise, Monthpay, is known, so the rule can be fired. The premise being true (since 42 is less than 50!), this yields a value for the sub-goal of Period, and allows Guru to fire Rule 1. That premise is true too, so the model has achieved its goal of finding a value for Intrate.

Rules and variables

Even the aforementioned simple model shows a major difference between the type of processing used in expert systems and in conventional programming. Within the set of rules, all are potentially available for processing simultaneously; we are not using a procedural approach, as in conventional programming. (Some regular readers may already be reminded of the approach central to constructing procedures using Intuitive Solution.) The order in which rules are evaluated to see whether they can be fired, the number of times they are evaluated (and fired), and other attributes, depend both on strategy and tactics. In Guru, the strategy for evaluation may be determined when the model is consulted; the possible strategies are summarised in Fig 1.

Within that overall strategy, to determine how and when rules will be evaluated and fired, Guru uses an approach with which Kman devotees will be familiar — that of environment variables. The particular variables involved are shown in Fig 2; initially the central variable is E.SORD. This consists of a list of codes, each indicating a criterion for judging the order of rule evaluation; the order in which these codes appear in E.SORD dictates the order of importance of the criteria. If the user does not change E.SORD (either by including an assignment within the model, or by altering E.SORD before issuing the Consult command), then rules are examined to see if they can be fired in the order in which they appear in the model. Other criteria include the cost of firing the rule (some conditions may be more costly to test than others: for

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example, if the condition involves an expensive laboratory test).

There are other differences, of course, from the approach taken in conventional programming. In the aforementioned example model, all the variables used had values which were known with certainty, but a major strength of expert systems such as Guru is their ability to handle uncertainty. Variables may be unknown, or may be known with varying degrees of certainty; they may have single values, or be 'fuzzy' — that is, may have alternative values (to a maximum of 255), each with its own certainty factor. Certainty factors may vary in value between 0 and 100, and may loosely be thought of as percentages — 'I am 90 per cent certain that it will rain today.' These factors are, however, independent of one another: the certainty factors of possible values for a 'fuzzy' variable need not sum to 100 — they may total less or more than 100.

To make this clearer, let's take another example. Suppose you wanted to build a system to help people choose an appropriate career. For any one person consulting the model, several of the careers you have included may be appropriate, with varying degrees of apposition. In Guru, the extent to which a career is appropriate would be called the 'certainty factor'. For instance, to someone who likes working with figures and who did well in maths courses at college, but who does not like working with people, a job in data processing might be appropriate, but perhaps less so than a job as an actuary. These judgements would be reflected in the certainty factor assigned to the two possible values — 'actuary' and 'dp staff' for the goal of 'best job'.

Variable	Default Value	Meaning
E.BEST	4	Maximum number of 'best' values (those with highest certainty factors) of fuzzy variables used when evaluating expressions
E.CFCO/ E.CFJO	M	Determines option used when combining certainty factors: M=Maximum, P=Probability Sum, A=Average of M and P, B=Balance of M and P
E.CFVA	PP	Controls determination of variable's certainty factor. May have one of 16 values: Probability Sum, Maximum, Average or Balance of Products, Minimums, Averages or Balances
E.HRES/ E.WRES	4	Controls degree of elaboration (1, lowest, to 6/5) in response to user who issues How/Why command to request explanation during consultation
E.ICF/ E.OCF	FALSE	Prompts the user for/displays a certainty factor when entering/displaying a variable via an Input/Output command
E.IFUZ/ E.OFUZ	1	Number of automatic repetitions of Input/Output command issued to get/display values for fuzzy variable
E.RIGR	M	Controls degree of rigour used when attempting to infer the value of an unknown variable: M=Minimum (consider no further rules when certainty exceeds E. UNKN), A=All (fire all relevant rules that can be fired), C=Considerate (consider remaining rules when variable's certainty exceeds E.UNKN, and fire each having TRUE premise)
E.SORD	F	Sequence of from one to six codes which determine the order in which competing rules are considered for firing; the sequence determines the relative importance of each criterion for rule selection. Codes may be: C (least cost), F (first in rule set order), H (highest priority — see options in Fig 4), R (random order), U (fewest unknown variables in rule's premise)
E.TRAC	N	Tracking level: N=None, F=Fired rules, C=Considered and fired rules, V=Verbose
E. TRYP	S	Defines strategy for evaluating premise having unknown variables: may be S=Strict (evaluate only if all variables can be determined), P=Patient (try to determine values for all unknown variables, then try to evaluate premise), E=Eager (evaluate premise after each unknown variable becomes known, halt testing when premise known)
E.UNKN	20	Threshold for certainty factors: a value with certainty factor below this threshold is considered to be unknown
E.WHN	L	Indicates when actions for finding values of variable are to be taken: may be L (as a Last resort), F (First, before trying to infer values for any variables), or N (Never)

Fig 2 Environment variables relevant to model consultation

Fig 3 shows part of an example of such a model, with the goal and two rules defined; this example is one of several included with the Guru software. The assignments to the variable 'best job' show the use of certainty factors in action. The operator += is used to indicate cumulative assignment to a variable: it enables Guru to accumulate certainty factors using an appropriate form of algebra. This form may be preset by the user with another environment variable; the form used allows for a range of degrees of rigour in the accumulation of certainty factors.

The general approach of accumulating certainty factors is intended to work much as human experts do. When making judgements, people tend to take a variety of items of evidence and consider them together, to build up their certainty as to which is the best solution. The level of certainty at which Guru regards a variable, previously unknown, as having become known (with a certainty factor) is controlled by the environment variable E.UNKN. The working of the model after the goal variable becomes known with minimum certainty is dictated by another environment variable, E.RIGR. (In the example shown in part in Fig 3, E.RIGR has been set to All, to ensure that all possible job criteria were evaluated before the model reached a conclusion.)

Fig 3 also shows some of the options allowed when specifying a rule. The full set of rule options is shown in Fig 4, together with the possible elements of the premise and conclusions of a rule.

In addition to a goal and the set of rules needed to reach it, together with the variables upon which the rule operates, a model may also contain other elements. These include an initialisation section, and a set of statements to be obeyed when the goal is reached. An instance of the latter (another part of the example used in Fig 3) is shown in Screenshot 2,

and gives rise to the display shown in Screenshot 3. This is typical of the use to which the completion section is normally put — that is, to show the user the result of the consultation, but you may also carry out any of Guru's other capabilities, as any Guru command (or command set) may be included here.

User image

When you have grasped the method of approach, Guru is quite a nice system to use: the menu-driven approach is remarkably helpful for those in the early stages of using such systems. And especially for existing Kman users, or those used to other command-driven database management systems such as the dBase family, the ability to use the whole range of Kman 2 facilities is a great help. For example, Kman 2 has some excellent screen-painting features, which takes care of the need to design a good user interface for the expert system user. Likewise, the ability to use the whole range of Kman data management features to add, edit and report on large quantities of data should be of great benefit to the expert system builder. (It is worth adding that certainty factors can only be applied to working (memory) variables. To store such variables in a database, you must store each value and certainty factor explicitly, perhaps in a pair of arrays for a fuzzy variable.) The ability to use graphics to display results or illustrate questions is also helpful.

That's the good news. The bad is two-fold. Firstly, the demonstration booklet which comes with the software does not correctly match the sample programs shown on the disk. Initially, the demo does not behave in the way the booklet says it should, and the booklet includes listings of two of the examples but not of the other two — the most important of which is not even mentioned. These may seem like minor quibbles, were it not that this is likely to be most users' first encounter with the documentation.

The lack of confidence thus engendered is fully justified by the manuals themselves. These are in three sections: a manual for Menu users, another for Command users, and a two-part *Reference Manual* for the whole system. The manuals appear to be comprehensive — as far as I can tell, given that they are every bit as impenetrable as those for Kman (both versions). It took me about six readings of the 'expert systems' sections in each of the three manuals to get any clue about what was going on, and give me enough knowledge to get started. Some use of the system then made it possible for me to go back and re-read the manuals, and after that I began to be comfortable with the package. But I am already familiar with Kman and its approach. I strongly suspect that novice users, especially those without much understanding of expert systems terminology, would gag on the first section and give up.

Conclusion

The inadequacy — or rather, the inappropriateness — of Guru's documentation is a great pity, because the expert system facilities are powerful and are provided with thought and care; with good documentation, they could be used to good effect by people who are prepared to take time to understand the product and its potential applications. As it is, I suspect that the package will be great for people who would otherwise be writing programs or developing extensive database management systems, but much less interesting to ordinary users.

Guru costs $4278 and is supplied by Database Network, Suite 3, 83 Glen Eira Road, Elsternwick, Vic 3183. Tel: (03) 523 8222. END

A rule has the basic form:
Rulename: IF conditions THEN conclusions
In addition, several options may be sepcified for a rule; any options not set take global default values, which may be altered by the system designer or the user

Rule premise conditions

Any logical expression, which may include: * Variables
— working (memory) variables
— field variables (from database table)
— cell variables (from spreadsheet)
— utility variables (for example, results of statistical commands)
— environment variables
* Functions (numeric, string, logical)
* Operators
— numeric (+,−,*,/,**,%)
— string (concatenate)
— relational (equal, not equal, ‹, ›, ‹=, ›=, within)
— Boolean (and, or, not, exclusive-or)
* Wildcard and pattern class matching

Rule conclusion (actions taken when rule premise is TRUE)

Any Guru command or set of commands, including:
Assignment of one or more variables
Requesting input from user
Displaying results to the user
Consulting other rule sets
Guru stored procedures
DBMS commands including query processing
Spreadsheet processing
Generating and displaying business graphics
Displaying or printing pre-prepared forms, reports and word-processed text
Communicating with another computer
Executing DOS commands and other programs

Rule options

Priority: May take values 1 (lowest) — 100. Used as one component in deciding which rule to evaluate
Cost: Relative indication or rule's cost, taking values 1 (lowest) — 100.
Ready: Sequence of commands executed before rule's premise is tested
Needs: List of variables whose values must be known before rule is considered for evaluation. Only needed if premise includes indirect references to variables (for example, macro returning a value needed to test the premise)
Changes: List of variables changed by rule's operation. Only needed if indirect references involved
Try: Indicates testing strategy: *S*trict, *P*atient or *E*ager
Comment: Comment seen by system developer during Build
Reason: Comment seen by user running Consult

Fig 4 Elements of a rule

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CPU	68000	80286	68000	68000
Speed MHz	8.0	6.0	7.83	7.16
Standard RAM	512k	256k	512k	256k
Number of Keys	95	95	59	89
Mouse	YES	NO	YES	YES
Screen Resolution	(Non-interlaced mode)			
Colour	640x200	640x200	NONE	640x200
Monochrome	640x400	720x350	512x342	640x200
Colour Output	YES	OPTIONAL	NONE	YES
Number of Colours	512	16	NONE	4096
Disc Drive	3.5"	5.25"	3.5"	3.5"
Built-in Hard Disk (DMA) Port	YES	YES	NO	NO
MIDI Interface	YES	NO	NO	NO
No. of Sound Voices	3	1	4	4

Don't take our word for it.

Listen to what computer specialists say about the Atari 520ST. Creative Computer October 1985 "Without question, the most advanced, most powerful microcomputer your money can buy..." Info World John Dvorak "I recently got to play with an Atari 520ST and found it to be a super little machine for the money."

Australian Computing June 1986 Neville Angrove "... the 520ST is a leading contender for the top position in the market, since it meets just about all the requirements of business."

More good news.

The Atari 520ST offers More Power for less price and large number of peripherals and accessories. There's a huge software library, which utilises GEM and includes overlapping windows, drop down menus and icons, through the mouse controller.

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Warranted and distributed by Mobex Pty. Ltd. Sydney (02) 406 6277. Melbourne (03) 329 5477. Brisbane (07) 358 5366. Adelaide (08) 212 7455. Perth (09) 328 3355.

Calcutronics Pty. Limited, 797 Glenferrie Road, Hawthorn, VIC. 3122. Phone: (03) 818 6631.
Alliance Computer Centre, 11 Cracknell Road, Annerley, QLD. 4103. Phone: (07) 892 1152.
The Logical Approach, Shop 5, Nettlefold Street Plaza, Belconnen, A.C.T. 2617. Phone: (062) 51 6349.
Computer 1, 202 Alison Road, Randwick, N.S.W. 2031. Phone: (02) 399 8865.
The Computer Centre, Shop 7G, Gays Arcade, Adelaide, S.A. 5000. Phone: (08) 223 6899.
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LETTERS

This is the chance to air your views — mail to 'Letters', Australian Personal Computer, 2nd floor, 215 Clarence Street, Sydney 2000. Please be as brief as possible and add 'not for publication' if your letter is to be kept private.

Compatibility

I read with interest your recently released 'Benchtest Special'.

As the owner of an NEC APC III since April 1985 I noted your observation in respect to the SLE Board which I fitted and, as you say, was not cheap. I needed to add some (otherwise not available to me) software and more specifically Microsoft Mouse Paint because of the wide flexibility this excellent program provides in creative artwork in conjunction with word processing.

To my consternation I found out after some hours that Microsoft Paint is in the same category as the software Decathlon to which you allude. It will not run on the not so compatible APC III. Only the graciousness of the supplier insisting that he take back the software avoided a pointless loss.

The APC III has been promoted as a high grade compatible ever since the time I purchased it. The wait for the expensive SLE Board was long — February 1986.

It is indeed a great pity that NEC, which has produced a superb piece of hardware, does not follow through and do the job properly. Perhaps we'll be offered a Mark II SLE Board when NEC realises the unhappiness otherwise devoted users of NEC equipment feel when they seek perhaps less glamourous but very essential software and discover the claim of compatibility has become somewhat misleading.

S Blair

Trespassers barred

I refer to the article entitled 'Trespassers Will Be Prosecuted', in the May 1986 issue of *Australian Personal Computer*.

Within that article is a statement attributed to Mr John Brothers, Netmap's Director of Marketing. Mr Brothers notes that "The news that hackers have doctored records of driving offences at a UK motor registry doesn't surprise Netmap. 'Wait till it's the TAB,' says Brothers, who also notes the ability of the malevolent hacker to put 'computer viruses', or mini-programs, into a network so the whole program corrupts and goes into an endless loop."

I find the above comment quite offensive. The TAB of New South Wales has continually applied a proper focus on its internal control. This focus ensures that the level of public confidence currently enjoyed has not been marred by any fraudulent or malicious incident. As the Netmap company is not in a position to be aware of the security measures currently in force, and the various cross checks, it is difficult to understand how such a generalised statement could be made.

G Corkill
General Manager
Totalizator Agency Board of NSW

Infinity, again

Regarding the question of infinity and the sum of the series 0-1+2-3+4-..., or if you wish, 2-1+4-3+6-5+.... As noted by B Sunderland (Letters *APC* April 1986), the second series is merely a re-ordering of the first. This re-ordering is not necessary to notice the strange nature of the above summation.

Taking the '0' as the first term of this sum, the '-1' as the second and so on, the total sum after including n terms is $[n/2](-1)^{n-1}$ where $[n/2]$=integer part of $(n/2)$; for example, [1.54]=integer part of 1.54=1.0.

We can now see that the more terms included in the sum (ie, the larger n) the more violently the sum swings between ever larger positive and negative values due to the $(-1)^{n-1}$ term.

This is not uncommon in the study of the sums of an infinite number of terms. It means that the sum does not 'converge' to a sensible result for an ever larger number of terms n. As a consequence, the idea of a total for an infinite number of terms in this sum is meaningless. This is the error B Sunderland and others have made.

Another point raised in the above mentioned letter is the nature of infinity. The author is correct in stating that "infinity cannot be treated as though it were a number". However, this does not mean that we can never sense a difference between infinities. The point to realise is that there are an infinite number of infinities. Also different types of infinity. For example, the infinity that results from the sum 1+1+1+1+...., is very different from that which results from $10^{1+1+1+1+....}$.

There is in fact a situation where physical sense can be made of the difference between two infinities (of the same type). In the study of modern quantum physics a mathematical procedure called 'renormalization' actually calculates physically meaningful, and experimentally verified, quantities by subtracting one infinity from another.

K Hinton

Faulty mathematics

An advertiser in the May 1986 edition of your magazine (let's call it Company X) proclaims proudly its unselfishness in seeking to make only 15% profit on the sale of its goods, while at the same time admonishing the competition for making between 25-60%: "We know you won't find a better price in Australia."

It so happens that I am in the market for a Brother Twinwriter 5 printer, and am interested in getting the best possible price as the RRP is in the vicinity of $1990. So the aforementioned advertisement caught my eye.

Company X advertises the Twinwriter at $1899. By using its own figures (ie, 15% profit), the wholesale price of this printer must be $1651. Imagine my surprise on turning to page 74 of this very same issue to find that a Sydney company, Archive Computer Services, is selling the same printer for $1650! These generous fellows are losing a dollar on every printer they sell.

Peace of mind in three sizes.

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Trade Enquiries Fujimex a Division of HANIMEX (02) 938 0241

Concord Syd. 1304 B.

This surely must be a misprint, I thought, or has Sydney stolen a march on Melbourne yet again? But no. On page 153 of the same issue a Melbourne company, Flowline Computers, has advertised a Brother Twin 5 for $1650.

Now using Company X's own figures, and assuming that these two other "naughty" companies are making 25% profit (let's keep it conservative), this means that the real wholesale price is $1320. At this rate, Company X's profit is 43%. Tsk Tsk. (I could be really nasty and assume that the competition is making 60% on the Brother and point out that Company X's profit is a whopping 84%! But I wouldn't want to rub anyone's noses in it, not me).

I can, of course, and will, buy the printer from the competition. But the thing that has put my nose out of joint is that this company must think that the buying public are dills. Do they really believe that, if the headline is big enough, we won't shop around? A company that thinks so little of their customers is not worthy of my custom. Integrity, honesty and a genuine desire to provide value for money are principles that a lot of computer retailers could strive for. I doubt that Company X wil be around long enough to foster these mighty ideals.
D Kruger

Benchmark highlights

As I was examining the Benchmark results for various personal and hobby computers, I discoverd the absence of a test which informs the potential buyer about the efficacy of the machines' screen-handling routines. I use a slightly modified BM1 which really highlights the difference. The program is:

```
10 FOR K=1 TO 100
20 ?K;" ";
30 NEXT K
```

The timing of this loop with scrolling, divided by the time elapsed for BM1, gives an arbitrary number for the time which the processor uses for screen-handling, as compared to calculations in a program.

A couple of factors:
IBM PC 14.0 (21 & 1.1)
Olivetti M24 17.5 (14 & 0.8)

The Amiga would really shine in this test, so why not give the people who produce machines with a separate I/O processor the benefit? A good (and fast) display is, after all, the interface to the user.
B Ardoe

Something completely different

Last year Bushcat introduced the world to our Bushlitt 1 micro, featuring the acoustic local area network (earplugs provided) and VTOS, the Virtual Time Operating System which allows an unlimited number of programs to be run concurrently by the simple expediency of using the fourth dimension to run some of them in the middle of next week. We now announce the Bushlitt 2, which improves the user interface and includes the latest release of our software.

Expansion slots

The system now accepts IBM-compatible expansion cards. The expansion bus is readily accessible under the rear cover — simply chisel off the rivets.

There are often too few slots to go round in most machines. For example, when one finds that the new graphics card needs a long slot, and there is just that

LETTERS

strange little half-slot left near the hot power supply which may be just long enough, but you'll never know because whereas it may be OK, and you can certainly get your fingers at it, you can't get your fingers and card there at the same time. Bushcat has concluded the licensing deal of the century with the ABC Mediocre Effects Department. Yes — every Bushlitt micro now has a chunky silver knob on the back which looks like a bit of yoghurt carton. If you run out of expansion slots, simply twiddle the knob and the inside immediately expands without affecting the outside dimensions. (Warning: Only ever turn the knob clockwise. Turning it anticlockwise reduces the internal dimensions and could squash any cards you may have installed. *Never* turn it past zero: the micro may collapse in on itself, turning into a black hole and disappearing up its own event horizon).

Peripherals

We at Bushcat pride ourselves on doing things just that little bit bigger and better. Our liquid helium-cooled laser printer can turn out 10 A4 pages a minute at 10 metres. No need to fiddle around loading those cut sheets — simply line them up against the wall, push the online button and stand well back.

Each printer is supplied with a warning sticker for the door, a klaxon which sounds when something goes wrong, and an 'I Was Tattooed by a Runaway Laser Printer' badge to amaze your envious friends.

Paul Hardy, Bushcat

END

SCREENTEST

Tripos

Philip Sargent presents the history and capabilities of Tripos, Metacomco's multi-tasking operating system which drives the Commodore Amiga.

Most people have heard of the Tripos operating system only recently as a consequence of AmigaDos, a version of Tripos written by Metacomco and released with the Commodore Amiga. Before Metacomco became involved, the Amiga development team had written their own message-passing and storage allocation 'kernel', and approached Metacomco only when the rest of their operating system development was behind schedule.

That Amiga kernel (called the Exec) had been written by people who had clearly read a few books on operating system design, so the job had been done properly and cleanly. As Tripos is the result of research projects in operating system design, the extremely close functional similarity between the Amiga Exec and the usual Tripos kernel is not entirely an accident. AmigaDos is thus the Exec kernel and Amiga device drivers (in assembler), plus the usual Tripos task handlers and file handlers written in BCPL.

AmigaDos differs from Tripos in having a completely rewritten kernel, but as far as the user is concerned, the differences are slight: AmigaDos time-slices tasks of the same priority, whereas Tripos does not permit different tasks to have the same priority. AmigaDos has 256 priority levels and Tripos has 65536, due to the fact that the original Tripos really only understands 16-bit words (as does BCPL), whereas the Exec has been written in terms of 8-bit bytes. Some recent versions of Tripos are more byte-oriented and are less closely integrated with BCPL.

The Amiga Intuition WIMP graphical user interface and the graphics support library reside in the same ROM in the Amiga as the Exec kernel, but are entirely independent of Tripos.

History

Tripos is a single-user, multi-tasking operating system for small computers, which originated in the University of Cambridge Computing Laboratory in England as part of a program of research into portable operating systems.

The name, Tripos, is widely thought to derive from Cambridge students' final year exams, which, in turn, are named after a (probably mythical) three-legged stool. In addition, both its detractors and its critics have sometimes referred to it as a *TRI*vial *P*ortable *O*perating *S*ystem: it lacks some of the features that are found in other operating systems, but its simplicity is closely related to its portability and is considered by many to be a great virtue.

What is a multi-tasking system? Imagine every program that you work with acting like Sidekick: immediately available at any time, without terminating your current task. Secondly, imagine that any of those programs can be working away in the background: compiling, answering the telephone, walking the dog, and so on. That's a multi-tasking system.

Operating systems other than Tripos have been implemented on a larger number of machines, and on a larger number of different types of machines; but very few other operating systems are so *easy* to implement. A recent port from one 68000 machine to another required a change of *only two lines* in the assembler kernel. Tripos has been implemented for the following machines: Digital PDP-11, Data General Nova, IBM Series 1, Intel 8086, and a large number of 68000 and 68010 machines including the Amiga.

Tripos originated in 1976 with Martin Richards in the University of Cambridge Computer Laboratory, and was devised for single-user mini-computers of that period. With the help of a number of research students, it was demonstrably up and running by February 1979. Unix predates it, but Tripos was one of the earliest operating systems written in a high-level language to have been specifically designed with portability in mind (Unix wasn't), and the only one to have gone beyond the experimental stage. It was designed to be portable, fast and small.

Tripos is used at Cambridge University for research, and former Computer Laboratory members have taken it with them to several companies where it is currently being used for software development companies such as Metacomco.

Modularity & portability

Tripos is an extremely modular system. It consists of only a 1500-line kernel and device drivers (for keyboard, screen, serial port, and so on) written in assembler, and four utility programs written in BCPL. The assembler is, as a matter of policy, always a manufacturer's standard assembler. A BCPL compiler is

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required; this is almost invariably also implemented in BCPL, and produces an intermediate code which requires only a simple interpreter. This is important — a portable operating system is *not* portable unless its base language is too.

The four cooperating utility tasks are:
1) a command line interpreter (cli);
2) an interactive debugger;
3) a console handler; and
4) a file handler
which behave as if they run concurrently. As the machine has only one processor, they are really only 'pseudo-concurrent', but the task-switching is built into the kernel and can do it in about 200 microseconds.

This concurrency must be distinguished from Digital Research's 'non pre-emptive multi-tasking' GEM-DOS (GEM on 68000 machines) where no task can be interrupted until it has finished; unlike Tripos tasks, they won't 'let go' or 'shut up'. This means that GEM-DOS operates like a task-switching system instead of a multi-tasking system: nothing happens in the background, so pauses while a word processor task is being typed in are not used for anything useful. True multi-tasking packages can be written to run under GEM-DOS if all the participating programs are written to use a sequence of extremely small tasks, but task-switching would slow things down. This can be contrasted with Tripos, where the operating system handles the multi-tasking, and any program can be written as if it had full control of the machine.

The file handler is the task which manages the filing system, and as it is a self-contained program, a variety of filing systems (with different disk formats) can be accommodated. If more than one such handler is loaded, then these filing systems can be used simultaneously.

The modularity of Tripos has led to confusion in some published articles, where the properties of a particular filing system have been assumed to be inherent to Tripos itself. The Metacomco AmigaDos filing system, with track cacheing and forward and backward block chaining, is more sophisticated than the 'standard' Tripos disk system where blocks just point back to the file header (as well as forward to the next, of course). Recent research projects in distributed operating systems have produced FS-Tripos and FM-Tripos (File Server and Filing Machine respectively), where the file handler may not reside in the computer at all, but in another computer somewhere else, which may or may not be anywhere near the hard disk pack. Such is the flexibility of the basic system.

The Tripos kernel and device drivers form a basis for embedded operating systems for specific items of apparatus or process control, by adding suitable interface handlers. Such Tripos-based systems have been used for a wire-wrapping machine and for a variety of dedicated network file servers. It is often argued that portable programs are good programs for reasons other than their portability, and this seems to hold for Tripos, too.

Files and file size

Whatever the filing system, Tripos implementations nearly always provide a hierarchical system with directories and sub-directories, as used by Unix, Acorn ADFS and Microsoft MS-DOS.

As it has been designed as a single-user operating system, Tripos has no protection against intentional destruction, but there are some safeguards against accidental deletion. Files and directories can be labelled with Read, Write and Delete access, so valuable files can be set so that the access must be changed before they can be altered.

Files are assumed to be an unstructured sequence of bytes, as in Unix. There are no filemarks at the end of files; the length is written, together with the name of the creator and the date, in the file header. Fileblocks can be read by random access within each file.

As different filing systems can be mounted, the restrictions on maximum size of file or maximum size of any one disk drive, are implementation dependent. There are two limitations: the number of bits used to encode the length of a file in bytes; and the number of bits

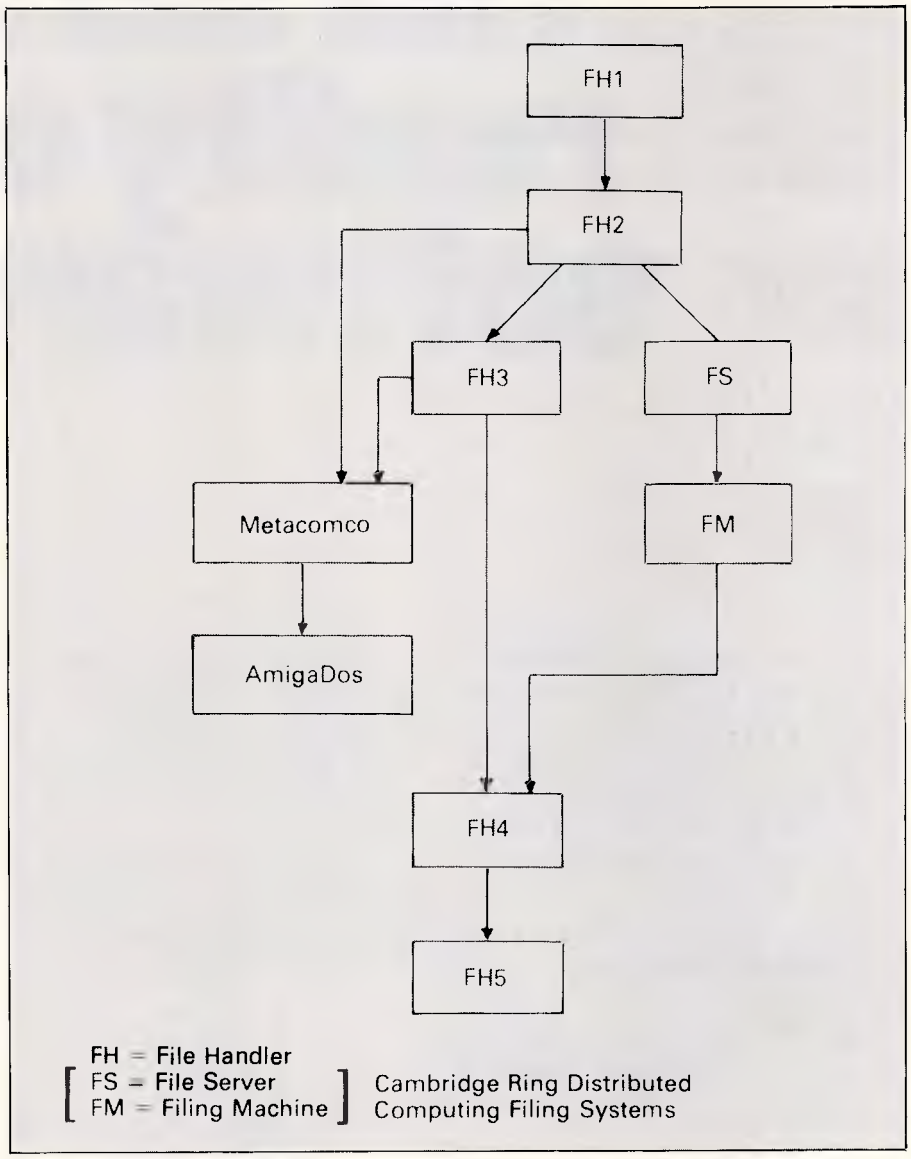

Fig 1 Tripos file handlers: a family tree

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used to store the disk key, which is a fileblock address. If the disk key is 16 bits, then there can only be a total of 64k blocks on each drive; and if each block is 512 bytes, this translates as a maximum drive size of 32Mbytes which is the same as MS-DOS. The length of the file is usually stored at 32 bits, which means that the maximum file size is 128 times the maximum drive size!

AmigaDos permits files to be split over several disks, but probably not over several drives. It all depends on how the file handler is written.

Simultaneous access

Tripos locks files against simultaneous access by means of a token-passing mechanism. Locks may be shared or exclusive, so a local area network of Tripos machines with a file server is a suitable vehicle for multi-user database or document processing applications, or developing any multi-user network application. Protection has to be built-in at the application level (OSI level seven), however, and is not provided by the operating system.

All current versions of Tripos implement locks on directories and on files, but not smaller-scale locking on blocks which is really required for safe database update applications, although the locks are perfectly adequate for shared-document access. This omission would be a disaster on any other non-modular operating system, but with Tripos, suitable file handlers can be built to almost any specification of that type.

A family tree of Cambridge Tripos file handlers is shown in Fig 1. FS and FM are the file server and filing machine versions for use with the Cambridge Ring, and FH4 is a local disk version which inherits their extra facilities (such as filename aliases).

The latest Cambridge version, FH5, is the one with the 32Mbyte drive size limitation because a 16-bit key saves disk space (FH1, 2, 3 and 4 use a 32-bit disk key and have a drive size limitation of 4Gbytes). Metacomco's several versions of Tripos for AmigaDos and other machines derive from FH3 and FH2, and follow an entirely separate, parallel line of development.

The 'standard' Tripos filing system is called FH3 and is shown in Fig 2. The more recent FH5 (used by Tripos III and developed by Micro Concepts) uses a slot/key elaboration which makes simple directory accesses much faster. Eleven file entries (slots) fit into each key fileblock, so a simple listing of filenames could be about 10 times faster. The file

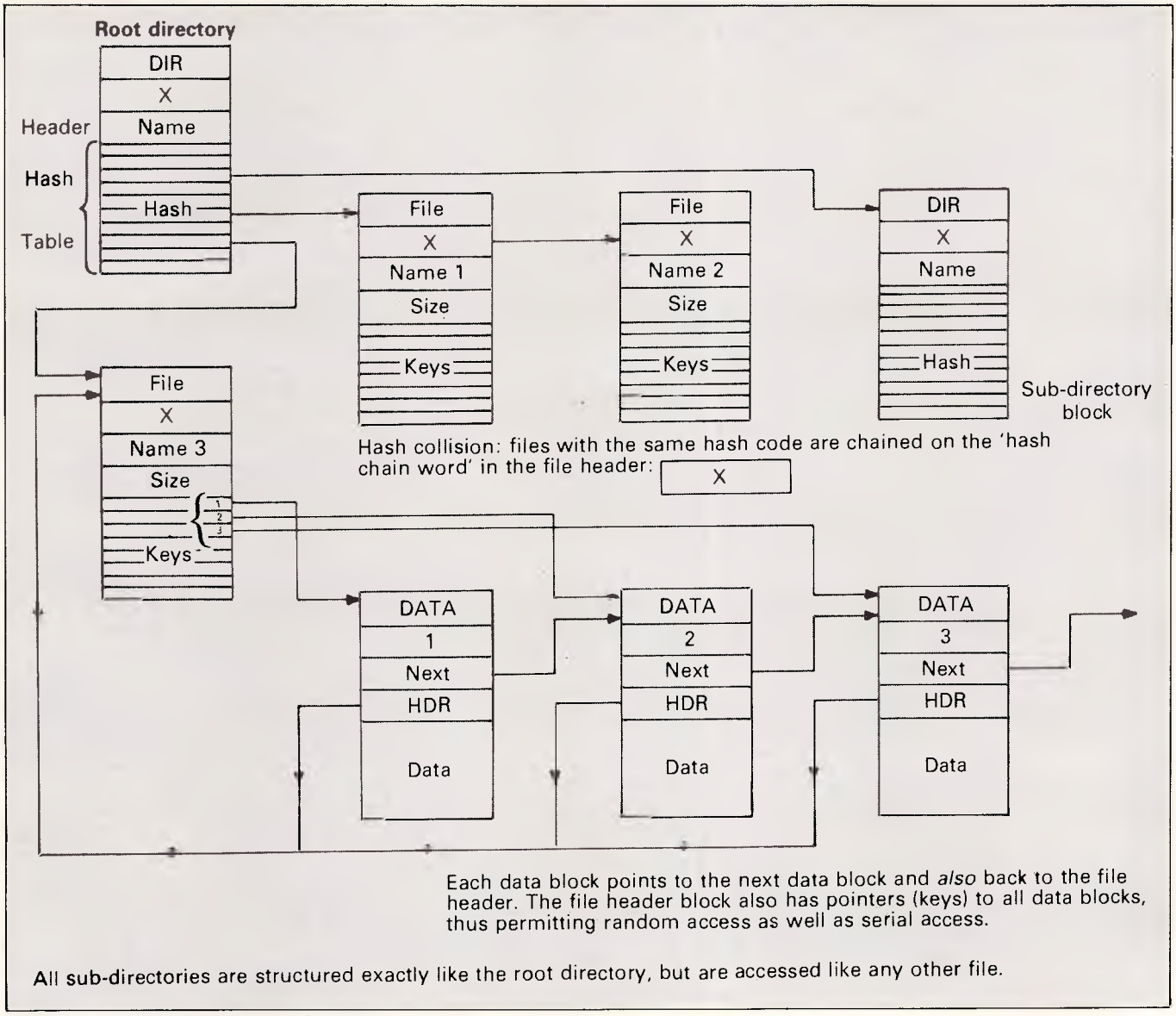


Fig 2 A 'standard' Tripos file handler: FH3

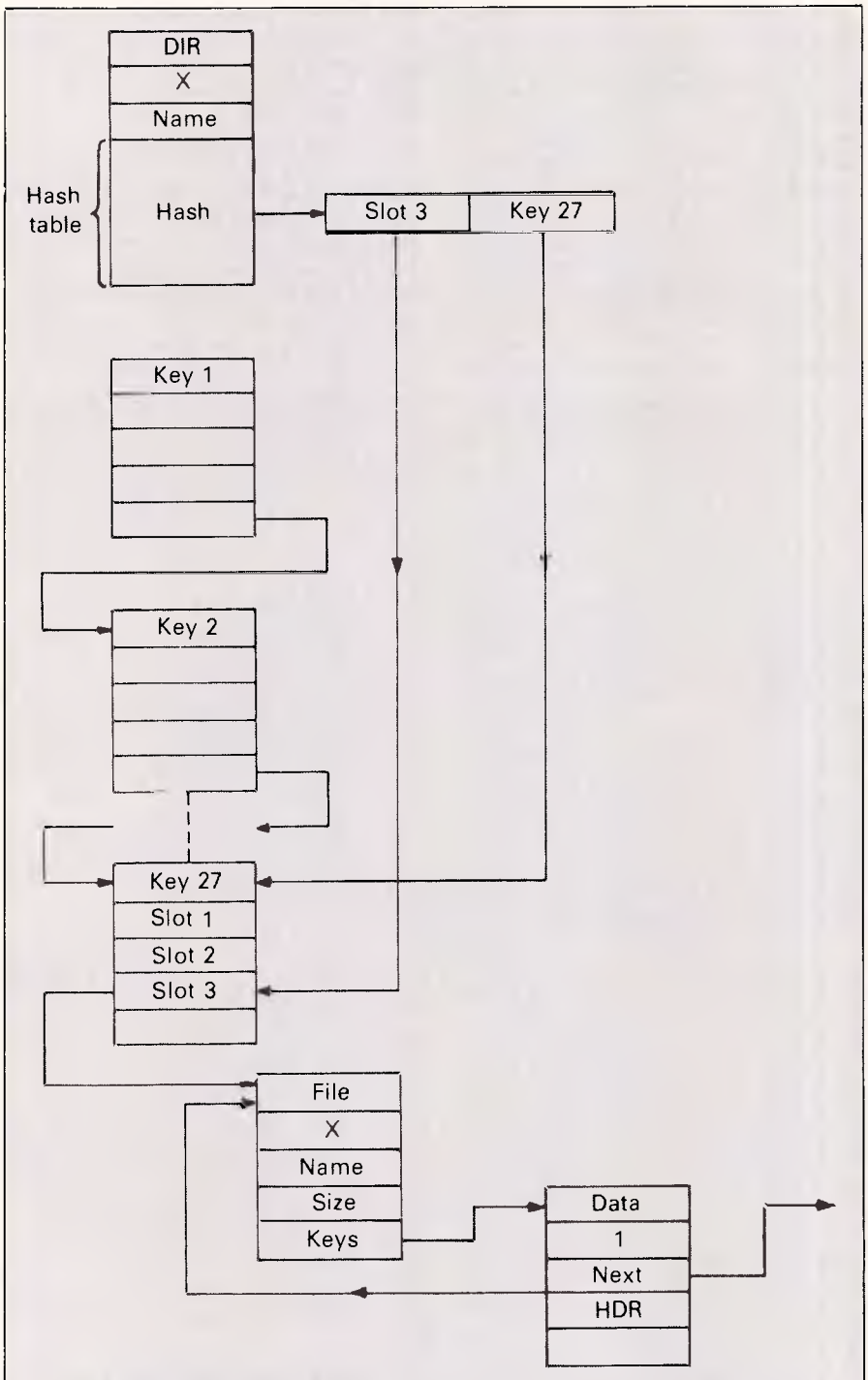
headers only need to be read if the size, time stamp or the name of the file owner is required.

Software

As Tripos has been used for so long in a research environment, there is a great deal of software available which has been designed for writing different versions of Tripos, but this is not what most people want. For 'generic Tripos' on 68000 machines, there are compilers 'available' for BCPL, Algol 68C, C, Pascal, Fortran 77, Cambridge Lisp, Prolog (NSW) and Ponder, and also an assembler and a disassembler. (Ponder is the result of research into functional languages, and it contains a rather unusual mouse-driven spreadsheet).

'Availability' is variable. Some software is for sale by mail order from Metacomco, and some might require licensing arrangements. Other possibilities are the Cambridge line editor, various screen editors, and the text processing/typesetting package, GCAL.

Many of the languages and packages available for basic 68000 machines can run easily under Tripos, so the Modula-2 and the Basic on the Atari 520ST and the Sinclair QL could probably be ported to a Tripos machine relatively easily (if they did not originate on one).



Exactly like the 'standard' FH3, but the hash table points to intermediate 'key blocks', which each contain 11 'slots' which are file header addresses. Holding several file header addresses in a single block speeds up directory access.

Fig A Tripos III file handler: FH5

BCPL

Tripos supports many languages but is written in BCPL, which bears the same relation to Tripos as C does to Unix. BCPL is, after Lisp, one of the easiest languages to port to a new machine. The compiler is written in BCPL and produces an intermediate code (O-code) for which a code generator must be written. For the initial port, a different, even simpler intermediate code, INT-code, can be produced by the compiler; this also requires a code generator. By comparison, C (and hence Unix) is much harder to bring up on a new machine. BCPL also benefits from its limited circulation in that there are very few different versions of the language, so although it has no ISO standard, it is much more portable than Pascal, which has.

BCPL is commonly described as an Algol-like language, which gives some idea of its age. C is a development of BCPL, and nearly all the differences between the two languages can be traced to the simple fact that C can access bits, bytes, words and longwords, whereas to BCPL, the world consists only of an expanse of uniform-length words (of at least 16 bits, but otherwise of any length) which are addressed as words, not bytes. BCPL, like C, has no strict 'typing' — that is, variables can be assigned to characters, reals, Booleans, and so on, and then to another type without restriction. Unlike C, BCPL makes no distinction whatsoever: types simply don't exist — there is only 'the word'.

The second main difference between BCPL and other compiled languages is in the data structures used to communicate between modules. Separately-compiled

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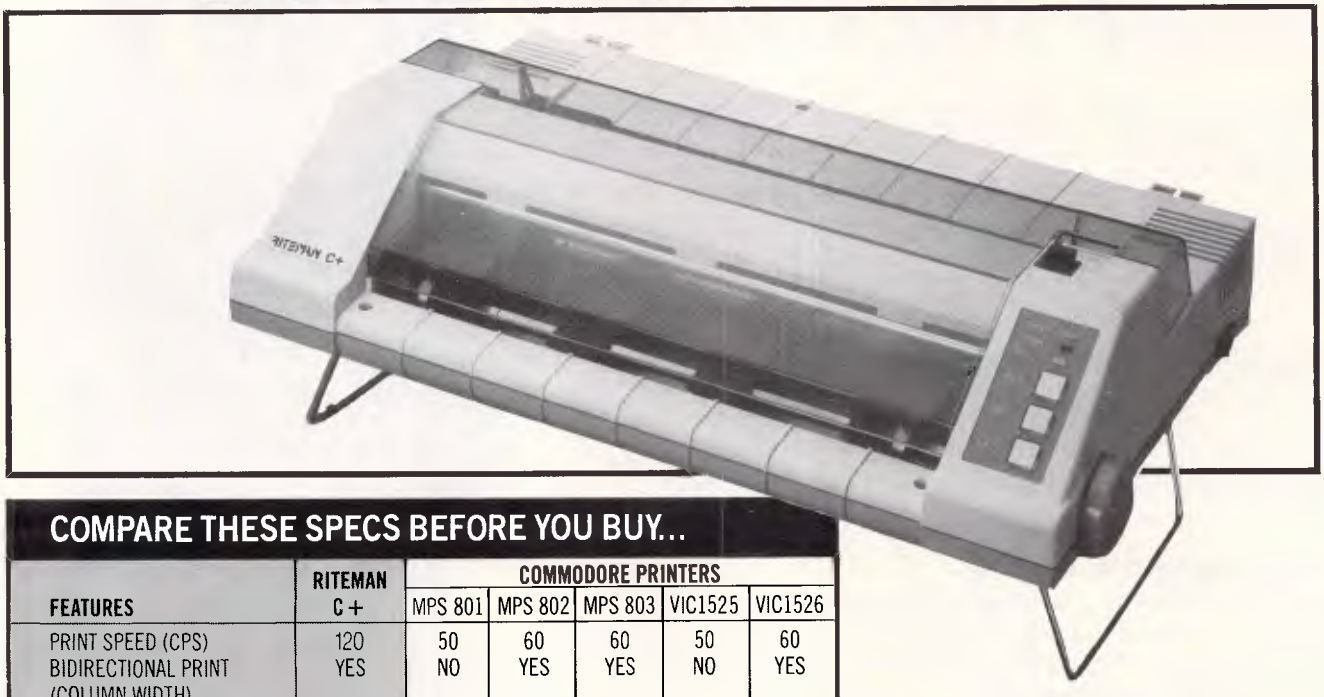

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modules generally communicate through a single 'global vector', which is just an unstructured area of memory containing words of data. The most important implication of this mechanism is that the programmer must personally ensure that the variables declared in the vector for each program match up correctly. BCPL subroutine libraries are, therefore, difficult to implement, but this is no problem for other languages under Tripos; in fact, some of the graphics-handling part of AmigaDos is written in C.

Compared to other languages, BCPL is an extremely simple, extremely dangerous language in which to write programs. Program development in BCPL implies that the machine has to be re-booted more often than is the case with other languages. But once programs have been written and debugged, their transparency and simplicity makes later maintenance easy.

In use

There are two ways of implementing a multi-tasking system: by memory sharing; or by message passing. These have been shown to be in some sense mathematically equivalent in that they can provide the same facilities, so the choice of which type to use must be purely pragmatic. Tripos is a message-passing system.

Tripos permits any task to create new tasks which then continue to run concurrently. Each new task is set up with:

— an identifying integer (for example, 5);
— a run-time stack;
— a global vector;
— an empty list of messages (the work queue);
— the task status (waiting, running, held, and so on); and
— a priority (an integer).

The priority can be changed after creation, but this is slightly expensive and not usually useful. Tasks in AmigaDos with the same priority are time-sliced by the kernel; in other systems, tasks are defined always to have different priorities.

Each task is allocated two areas of memory — a global vector and its run-time stack — and is told about certain system structure addresses, and can 'see' its queue of incoming messages. It usually does not know, and need not know, anything about other tasks in the system, but as all Tripos programs have access to the whole memory map, a pathological task can corrupt others. A task can safely request more memory for its stack, and de-allocate memory when it has finished with it by using routines in the kernel. At the end of a task, all memory is de-allocated.

Within each task there can be a number of co-routines which bear the same relationship to tasks as tasks do to the operating system. They are pieces of code which do not hand over control to another routine within the task until they decide to, but as they are just parts of a task, the whole task can be swapped in and out without the co-routines 'realising'. A co-routine is allocated its own run-time stack, but shares the global vector of its parent task. Co-routine switching is approximately 10 times faster than task-switching, and co-routines offer most of the advantages of tasks but without synchronisation and time penalties. They are widely used in the Tripos system software.

The command line interpreter (CLI) is used to interpret strings typed at the keyboard (or sent over a network) as commands to run utility programs. The utilities supplied with Tripos have exactly the same status as user-written programs, and are run as co-routines of the CLI task. One of these utilities is the Run command, which creates a new CLI task and takes the rest of the input line as a program to run in that task. For example, 'Run BCPL from t-s to t' creates a background task which goes away and compiles the BCPL source file, t-s. When it finishes the compilation, the task commits suicide. If automatic suicide is not wanted, typing 'NEWCLI' creates a permanent, new CLI task which writes to the screen and reads from the keyboard. Keyboard input is directed towards the intended task by means of a typed escape sequence, or, with Intuition and AmigaDos, by moving the mouse to the required CLI window.

One of the ways in which the system can achieve efficiency in a small system is by running all tasks in the same address space, so when running, it can take up less space than it requires for disk storage (which is about 68k for Tripos III). In any case, common pieces of code, such as the entire run-time library, are shared between tasks.

Comparison with Unix

Tripos is not a virtual memory system, whereas Unix is. On a Unix machine, programs 'see' an expanse of RAM which is equal in size to the maximum address space, rather than the real RAM size, because the operating system swaps programs and data in and out between disk and RAM 'behind the back' of any executing program. The most obvious consequence of this to the user is that on a machine of similar size, Tripos's response to input is much faster.

At a slightly more sophisticated level, because Unix files have a kind of ghostly existence, it is possible to 'pipe' files from the output stream of one program into the input stream of another without pausing for breath. MS-DOS also has pipes, but they are really hidden temporary files; all the output from one program has to finish before the next can begin (unlike Unix, where it happens on the fly).

Tripos does not have virtual file handling, but since 1981 Tripos has included a pipe handler utility which sets up a concurrent task to pass data like a Unix pipe. More recently, this has been reimplemented in Tripos III so that the pipe task can be treated almost exactly like any other file, and so provides the same level of utility as does Unix.

Tripos and Unix have a kernel written in assembler. The Unix kernel is much smaller than the Tripos kernel, but a greater proportion of Unix is written in C than the proportion of Tripos written in BCPL. The speed of operation of Unix is much more dependent on the quality of the C compiler than the speed of Tripos depends on the BCPL compiler. Thus, even discounting the virtual memory overhead, Tripos is smaller and faster. With Unix, the hand-coding effort in porting goes into the C compiler, but with Tripos it goes directly into the kernel.

Comparison with Panos

Panos is another new, small operating system written in a high-level language. It is supplied by Acorn for its Wordstation series, which is based on NatSemi 32000 processors. Panos (the name is reputed to come from a Greek restaurant) is extremely recent. It was first seen by beta-testers of the Acorn 256k NS32016 co-processor in about March 1985, and a debugged version (1.1) was released in October of that year. It is nearly nine years younger than Tripos.

Panos is written in Modula-2+. The '+' denotes a version of Modula-2 which has been enhanced by the DEC Palo Alto Research Centre in the US to include handling exceptions, finalisation, garbage collection, controlling concurrency, and providing a type-safe discipline for managing storage. It is apparently not (currently) for sale, but is probably quite portable. Modula-2 has great advan-

tages for the writing of most system software, as it has strict type checking and yet allows easy access to the fundamentals of the machine (by means of the type 'word', for example). Type checking between tasks is not possible in Tripos because messages are passed only by a pointer to an address, so there would be no great advantage in re-writing Tripos in Modula-2 (or C), even without the consideration that BCPL is the more portable language.

Panos is not a multi-tasking system, but it inherits a great many other features from Tripos. This is a reflection of the fact that for a number of things fundamental to small operating systems, Tripos has 'got it right'. The single-tasking nature of Panos is a reflection of its origins as an operating system running on a second processor attached to a 6502 host processor via the Acorn Tube interface. Apparently, the requirement that the new system be upwards-compatible with the host processor hardware mitigated against a message-passing system.

The command line interpreter (CLI) utility in Panos uses almost exactly the same keyword handling mechanisms to pass parameters to applications programs as does Tripos. Similarly, there are special keywords such as 'help' which do not run the utility, but tell you what parameters you should have given. Parameters are set-up with options such as: /A, meaning a compulsory parameter — a value alone may be given and is identified by position; /K, meaning a keyword must be quoted; and /S, meaning a switch, no value required, only the presence or absence of the parameter (for example, list or nolist).

Panos implements the same ideas as Tripos in that the system utilities have exactly the same status as user-written programs. As with Tripos, users can rewrite the directory listing utility, or a Type or List command, or anything really, with impunity. Panos also permits any program to initiate the execution of any other program, thereby supplying some of the same facilities to the user that multi-tasking does for Tripos, but no background tasks are possible.

Within Tripos, it is not usually (or safely) possible to call any program from within any other; use is made of co-routines and tasks instead. There are no fundamental reasons why such a system (essentially, just enabling the execution of NEWCLI) could not be implemented with Tripos, but it would add little to the facilities currently available.

The Cambridge Ring

It would be impossible to describe Tripos without a mention of the parallel development which has shaped its growth — the Cambridge Ring. This is a slotted-ring (*not* token-ring) local area network (LAN) with continuously circulating packets. When a station wishes to communicate it waits for a packet, and writes its message, and the address of the recipient, in the appropriate fields.

There are approximately three packets at any one time on a 600m ring, travelling at some appreciable fraction of the speed of light and passing through shift registers at each station. The original ring ran at 10Mbit/s; the Cambridge Fast Ring (CFR) will run at 50Mbit/s, and slotted rings of that type are probably the only local area network which can guarantee LAN access for a station at intervals short enough for it to be used to carry speech.

Tripos and the Ring enable computers to be attached to a LAN with no peripherals at all — no keyboard, no screen, no disks. A user with a simple terminal and a ring station can attach to any free computer and use it as if it were sitting on the desk. Tripos's fast handling

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of messages and tasks, its assembler-written kernel, and its modular nature, are all intimately connected with this distributed computing project. Nearly all the servers on the Ring (plotters, fileservers, ring bridges, and so on) also run with a Tripos kernel and a different set of utilities.

Recent developments

The most significant recent development is the release of the Amiga, running Metacomco's Tripos (AmigaDos) with a new filing system, a kernel and a graphical user interface (Intuition) which permits separate windows for concurrent tasks. More fundamentally but less visibly, Micro Concepts' Tripos III includes two new basic utilities to add to the usual four: an Object Manager; and a Volume Manager.

The Tripos III Object manager automatically keeps the most recently-used commands and utilities in any spare RAM so that if used again, they will run immediately. In MS-DOS terms, all programs become resident as soon as they are used, but are 'ducked out' (invisibly) if the space is required. This overcomes part of the speed disadvantage of a disk-based as opposed to a ROM-based copy of the system and utilities. The Object Manager is a task, but the utilities it swaps in and out are not tasks as they are not running anything.

The Volume Manager can be used with any mass storage system with removable media (usually floppy disks), and simulates multiple drives if only one drive is connected. It does this by prompting for the right disk to be inserted whenever another drive is required.

The Object and Volume Managers are particularly useful in: (a) reducing the length of time spent reading disks; (b) making it possible to use non-system disks because many utilities have been loaded into RAM; and (c) making do (cheaply) with only one drive. Their development was probably hastened by the fact that Micro Concepts' prototype machine had only one 200k, single-sided, single-density floppy drive, and all the initial Tripos development was done using this (try doing that with Unix). Tripos is very small: the kernel device drivers, system utilities and BCPL compiler (both source and binaries) will fit on one 720k, 3.5in floppy disk.

Wild-character expression, such as is available with MS-DOS where a '*' means any sequence of characters in a filename, is not currently part of the Tripos or AmigaDos CLI, and has to be handled by each applications program. Micro Concepts' Tripos III will include this facility in the CLI and as an operating system function call.

Future implementations

Despite the apparent predominance of 68000 and 68010 systems, Tripos is not limited to those machines and will run very happily on any system with a 'flat' address space; more than about 128k of word- (not byte-) addressed, unsegmented RAM; a floppy disk; and a 16-bit or a 32-bit microprocessor. In practice this means a 32-bit processor, as the common 16-bit micros do not implement word processing (for example, the 8086 and 80286).

Future implementations of Tripos can be expected on NatSemi 32000 series microprocessors, which are generally considered to have a cleaner architecture than the 68000, and a version for the Atari 520ST could probably be brought to market extremely quickly if there were demand. Tripos should also run very well on most RISC machines, such as those produced by IBM (the PC/RT), and Acorn (the ARM) but its message-passing system would not sit very happily on the Transputer, which passes messages as data rather than by an address pointer. Tripos is a high-level system and is not dependent on the physical size of the databus, as long as it is adequately multiplexed. It could run on (cheap) machines which use 8-bit bus versions of the 68000, the 32000 or the ARM.

Although there is not much to be gained by rewriting Tripos in a language other than BCPL, for reasons of business confidence it is possible that a C-based implementation may have more commercial success, even though from a standing start, a BCPL implementation is probably faster to port onto a new machine.

It is possible to envisage a virtual memory version of Tripos, where a number of virtual Tripos machines would run as tasks on a conventional Tripos system. This would slow down the response, but that is inevitable for all virtual memory operating systems (such as Unix).

What happens next with Tripos depends directly on how many systems are ported onto how many more machines. New machines are constantly appearing, and easily portable operating systems (POSs) have a distinct speed advantage in the porting procedure. By a process of natural selection, portable systems will gradually displace the CP/M-alikes and MS-DOS-alikes of the world from the next generations of small, powerful computers in business, education and the home, as well as making inroads into embedded systems and programmable controllers.

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Anarchy reigns because the whisky brewers have been dismissed, and an ever-so-nice detective is being shot at. Stephen Applebaum brings a sober restraint to this month's games review.

Tall tales

GAME: The Pawn
MACHINE: Atari ST
SUPPLIER: Chambers Computer Supplies
PRICE: $99.00

The standard of graphical adventures has never been very high, as programmers have been restricted to the meagre amounts of user RAM available in most popular home computers. There have been some successes, but even these display an uneasy compromise between the standard of their pictures and the amount of text available throughout the game. Graphic locations usually consist of numerous but inadequate vignettes, while small vocabularies vex, rather than entertain, players.

If you agree with this view, you'll welcome the launch of Rainbird's Atari ST version of The Pawn. The Pawn is a highly-charged adventure based on that old chestnut, the struggle between good and evil.

This latest conversion has been eagerly awaited by adventure game players, not least due to some of the claims put out by the program's designers.

Told through words and pictures, The Pawn is a stunning combination of art and good, old-fashioned adventuring. To complement the game's atmospheric, and at times humorous, text, a professional artist was asked to create the program's graphics. The result . . . well, you only have to look at the screenshots to see what an excellent job he has done. Some are florid, whimsical affairs, while others, especially those depicting the rank forest, are Daliesque.

Below each picture is a bevy of pull-down menus disguised as scrolls, which contain options to save a game in progress and load an old one, or change the text size on the screen so that it can be read more easily. One scroll features a series of commands to adjust the way in which a picture is displayed on a black and white screen, to give you the best possible quality. If you have a printer, there is a facility to dump your input/output onto hard copy.

All The Pawn's action takes place in the magical world of Kerovnia at a time when its ruler, King Erik, is losing control over his subjects. One of the reasons for his sudden drop in popularity is his refusal to reinstate a race of dwarves, one of whose number he believes to have been responsible for the assassination of Queen Jendah II.

Kerovnia's drinking fraternity has mourned the departure of the dwarves, for it was they who were responsible for the distillation of the smoothest and strongest whisky around.

In the dwarves' absence, the drinks market has been dominated by two companies which produce real ale and spring water respectively, and which have a vested interest in making sure that the dwarves' exile is permanent. However, their hopes could be dashed by the people of Kerovnia, who are beginning to believe that the dwarves are, in fact, inno-

cent, and should be allowed to return to the drinks scene.

With his popularity waning, King Erik must act positively or be defeated by his own apathy. And as if things weren't bad enough, there is also a general election on the horizon.

At this point in the story, you arrive on the scene as a king of *deus ex machine*. It is up to you to direct events, and possibly effect the reinstatement of the whisky-swilling dwarves.

At the beginning of the game, most directions are open to you. A quick check on your inventory shows that you're wearing a pair of jeans (no special make), a shirt, and a silver wristband which can't be extricated from your arm. How to remove the wristband is an important puzzle which must be solved before you're allowed to enter several of the game's locations.

What you are supposed to do at this point isn't clear, and the situation remains that way until you have met various Kerovnian inhabitants. These include: Honest John, a not-so-honest salesman; Kronos, an evil wizard; a guru; the devil; Jerry Lee Lewis (yes, *the* Jerry Lee Lewis); and a legless horse, to name but a few.

One thing I *can* tell you is that there is a vain maiden to rescue, although I didn't manage to find her. I have been assured that she *is* there, but judging by what I've been told about her, you're more likely to want to leave her locked up than have her nagging you for the rest of your difficult quest.

Compared to some adventures The Pawn is quite small, with only 100 locations (35 being graphical ones). Even so, it is believed that even an experienced adventurer will take upwards of two months to complete it, and then not necessarily have scored a maximum 350 points. Like other adventures which involve the player scoring points for solving puzzles or riddles, The Pawn can be completed in many different ways, only one of which is correct.

Communicating with the computer is not such a laborious process in The Pawn — so many of the problems are easier to deal with than in some other adventures. This is thanks to a clever parser which lets you input commands as you would probably say them in everyday speech.

Multiple actions have been catered for, as have pronouns, dramatically reducing the amount of typing required to perform actions. But even with these little luxuries, I kept my commands concise, subconsciously confining myself to the inflexibilities of other adventure games.

For those players who reach an impasse, Rainbird has included some ingenious ciphers in The Pawn's manual which allow you to obtain hints. Typing the word HINT, followed by a code given in the game's manual, will present you with a clue.

There are ciphers to cover most of the major problems encountered, and also some bogus ones which, when you have typed them in, come back with a sarcastic comment. The Pawn is all tongue-in-cheek stuff, and it is easy to get caught out.

The Pawn has many good points in its favour and there is little that can be criticised, but two of its major failings are the use of English and the many spelling mistakes, especially those in the hints returned after inputting a cipher. One example of the former criticism is when you are told that you are 'carrying a white'; an odd statement until you realise that you are, in fact, carrying white light.

Both these glitches reveal a degree of slackness which could have been overcome by thorough testing. There is also a minor bug in the ciphers, which has been cleared up as an addendum, but which again should have been caught at an earlier stage.

Apart from the odd slip-up, The Pawn is a major leap forward in the world of graphical adventures. It isn't the last word, but it is a guiding star which others will hopefully follow.

Private investigations

GAME: Borrowed Time
MACHINE: Apple II
SUPPLIER: Imagineering
PRICE: $39.95

Being a detective isn't easy, especially when you're living on borrowed time. And that is just what you *are* doing in Activision's latest illustrated text adventure of the same name. In a game which closely resembles Mindscape's trend-setting Deja Vu, reviewed in the May issue of *APC*, Borrowed Time is a colourful *Boys' Own* story, written by the authors of Mindshadow and set in the America of the mid-1930s.

Like its Macintosh counterpart, you once again take on the persona of a private detective, this time a detective called Sam Harlow.

You've always thought of yourself as an amiable kind of guy, loved by all except those whom you caught and threw in the slammer. It comes as a bit of a shock, therefore, to find that someone is trying to kill you.

Who and why are the two questions swimming around inside your brain. With little thought, you hit upon the only sensible solution: get them, before they get you. As this is not a Humphrey Bogart movie, you can't simply kill whoever you believe your assailants to be. Instead you must be shrewd, and collect enough relevant evidence to convince the police of that person's (or persons') guilt.

To get your man (or woman) you have to be prepared to take risks. For instance, after only several moves into Borrowed Time, you find yourself being shot at and pursued across a washing line which is strung precariously between two adjacent highrise buildings.

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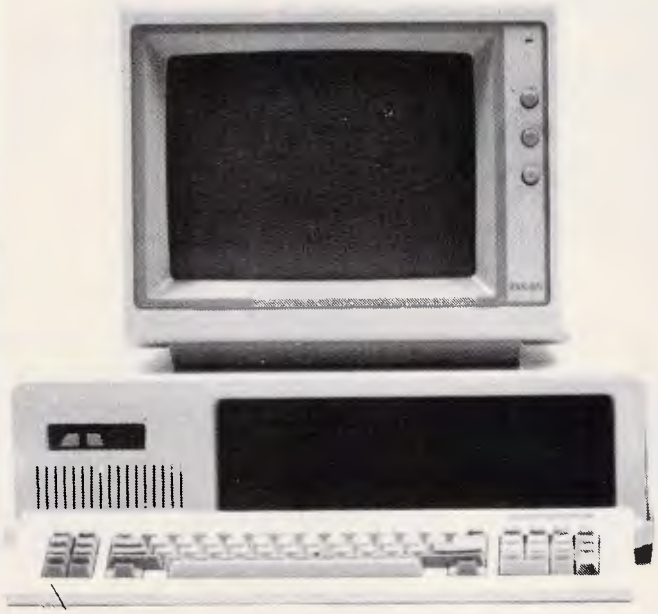

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form, and more often than not contains some small, animated detail. In your office, a ringing phone jumps up and down on your desk, while in another room, bubbles gently rise and burst in a glass water dispenser. Also, other characters are able to communicate with Sam Harlow.

Next to Borrowed Time's graphics window is a list of useful commands which can be accessed with a cursor, moved using the mouse. Here, you find such useful functions as: search, show, cut, and open.

There are 24 verbs and nouns featured onscreen, but many more can be used by typing them in as you would any other adventure. Several commands which have been dispensed with are those used for movement; they have been replaced by a compass, allowing the player to move by placing the cursor on any of the four cardinal points and clicking on the mouse.

Below the graphics window and the aforementioned box of commands is a rectangular space, into which go the objects collected during your investigations. When an item is removed and replaced somewhere else on the screen, the computer assumes that you have dropped it.

Borrowed Time is an intriguing game, and it is reassuring to find other games producers going along the same path as companies such as Mindscape. I don't feel that it is quite as good as Deja Vu, its only other rival, but it is certainly better than the majority of so-called illustrated interactive adventures.

I do have one complaint about Borrowed Time, however, and that is that some of the sticky situations which you find yourself in seem to allow you fantastic routes of escape. A good illustration of this is the moment when you find yourself suspended by your wrists, which have been tightly bound together with twine and fixed to a door lintel. Like any hero, I nimbly swung my legs over a table and somehow managed to pick up a matchbox and a candle. Although hanging from my wrists, I was still able to light the candle and burn the twine, so freeing myself. Beat that, Bond. END

Reach for the sky

The University of Surrey in Britain is currently operating two satellites, UOSAT 1 and UOSAT 2. In the last of their series, Robin Mudge and David Furst look at what scholars and hobbyists are doing with these spacecraft.

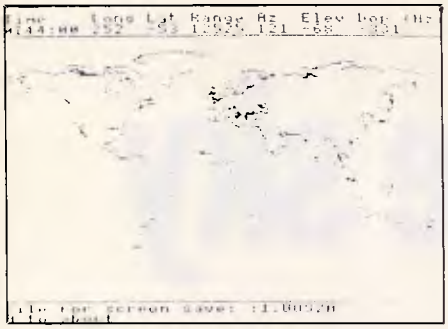
In 1945, Arthur C Clark outlined an idea for placing three artificial space satellites in orbit around the world at a height of 35,880km above the equator. At this height, the satellites would orbit the earth once in 24 hours and so keep a fixed position relative to the earth's surface. Between these three geo-stationary satellites, a complete global communications system could be established.

In 1986, communications satellites have become big business. There are thousands of them in orbit around the earth; they have brought television and radio to the remotest parts of India; they have given the US its first national newspaper, *USA Today*; and they supply more than 12,000 global telephone circuits.

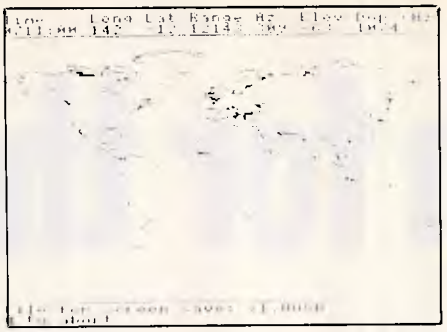
DIY satellites

Most of the aforementioned satellites cost millions of dollars each, but orbiting among them can be found Oscar 1, a satellite which was built on the kitchen table by a group of enthusiastic radio amateurs (hams). Oscar stands for Orbital Satellite Carrying Amateur Radio. Oscar 1 was built in 1961, and since then there have been 11 others.

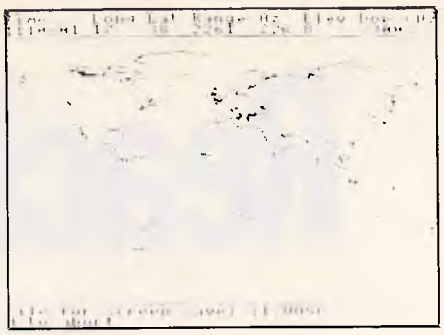
Each 'home-made' satellite has been designed to help hams communicate with each other on a world-wide basis, in a more reliable way than they can by using the familiar short-wave radio bands. Radio hams are people who are interested in the technology of radio communications. They have often been at the very forefront of research (they contributed enormously to discovering how radio waves propagate around the earth), so it's not surprising to find them



Movement of the earth . . .



. . . below the satellite



An example of satellite passing

Satellite tracks

Polar view

Paths traced over 24 hours

active in the field of satellite communications.

Two 'home-made' satellites, Oscar 9 and Oscar 11, carry a number of space science experiments onboard which measure all the functions of the satellite's systems, such as battery voltage, solar cell current, and temperature. Other instruments measure the earth's magnetic field and solar radiation, perform spectral observations, take dust particle measurements, and there is a CCD camera which takes pictures. All this information is transmitted back to earth by radio in ASCII code at 1200 baud; the method is called telemetry, and can easily be received by enthusiasts. Once received, your micro can help you to interpret these messages, and you are ready for some real space science experiments in your own home.

Receivers

Oscar 9 and Oscar 11 are operated by the University of Surrey and are called UOSAT 1 and UOSAT 2 respectively. Both transmit their telemetry on 145.825MHz.

The best receivers for satellite work have an auto recorder switch. This is operated by the squelch control: when a strong signal is received, the squelch turns on the tape recorder. It is turned off again when the signal fades. It is advisable not to use a top-quality recorder for this purpose as the machine has to be left in the 'Play' position for long periods. This leaves an indentation on the rubber pinch wheel which moves the tape. It's OK for satellite signals, but it plays havoc with the wow and flutter figures when used in a hi-fi system!

The signals from UOSAT come and go because they are both in polar orbits; these take the satellites over the north and south poles. UOSAT 1 and UOSAT 2 are about 554km and 700km high respectively, and they take about 90 minutes to complete each orbit. Their orbits are fixed in space, one at 90 degrees to the other, and the earth revolves under them, once every 24 hours. Each hour, the earth rotates through 15 degrees, so each time the satellites come around, they are over a different part of the earth. In theory, each satellite will come overhead twice a day — once in the daylight (travelling north to south), and once at night (travelling south to north). In practice, though, an antenna with a wide angle of acceptance (like a turnstile) is used, so it captures signals from passes that are at either side of the main overhead ones. To increase the strength of these rather weaker signals, a 'preamplifier' can be used. The best type fits onto the antenna, boosting the weak signals before passing them down the cable to the receiver. You can use a preamplifier at the receiver, but the interference and noise introduced to the signal in the connecting cable will then also be amplified.

Frequency

Specialist receivers have a rather unusual tuning circuit which takes care of a troublesome effect called the Doppler shift. In England both MM Microwave and Timestep Electronics produce such receivers, though they are not available locally. This Doppler Shift is the same effect that you hear as a police car or a train approaches you at high speed, sounding a siren; as the vehicle passes, the siren seems to change pitch and lower in tone. The siren produces a note of a specific frequency (frequency is the measure of the number of complete waves passing a fixed position in one second (called Hertz)). The frequency is fixed by the speed at which sound travels and the wavelength of the sound wave. The siren is on the car and it produces a sound of fixed wavelength which travels at a fixed speed — but the car is moving forward at a high speed. The speed at which the sound waves reach you equals the speed of sound plus the speed of the car, so the frequency of the note will seem higher. As the car passes you and goes away from you, the speed at which the sound reaches you is the speed of sound minus the speed of the car; the frequency will be lower, so the note will be lower. At the point at which the car passes you, you hear a tell-tale change in pitch as the speed of the sound waves changes.

The same thing happens to radio waves. The satellite is travelling at a very

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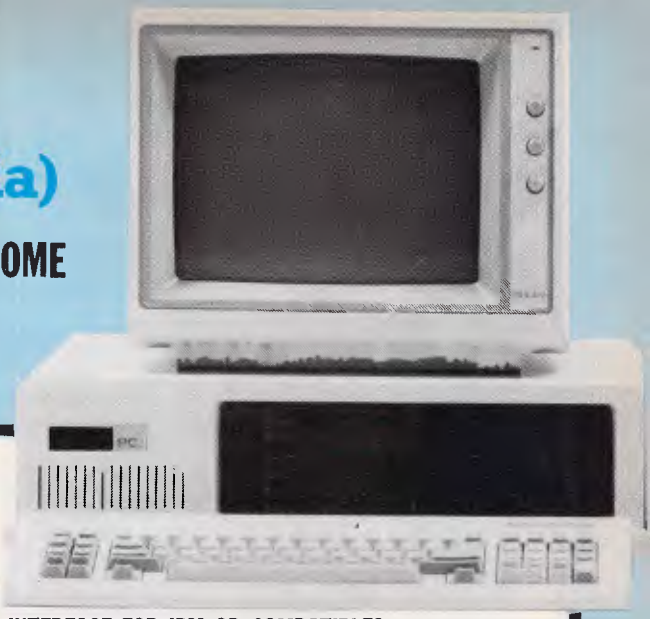

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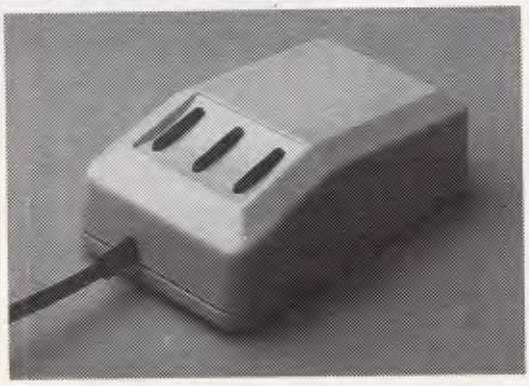

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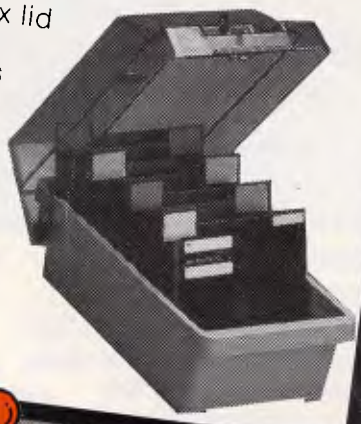

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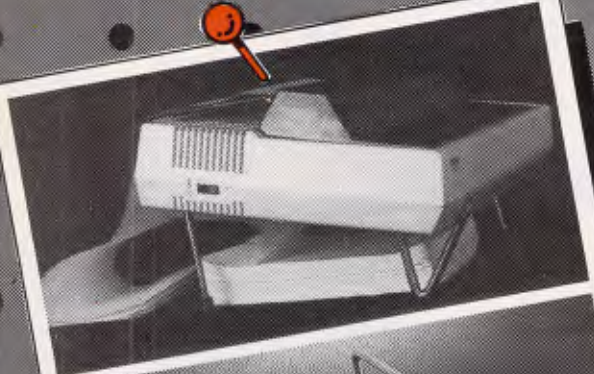

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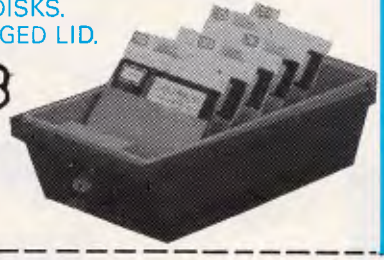

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high speed, so the frequency changes as it approaches and leaves in the same way. The specialist receivers incorporate a phase-locked loop design which tracks the tuning to exactly match the received one.

The signal is an FM transmission, so any receiver which can tune into that frequency can be used. There are a number of interesting scanning receivers available — most of which can't handle the Doppler shift directly, but the signal can be kept in tune. The scanning receiver can be set to scan between the highest and lowest frequency limits, so when the signal goes out of tune, the receiver steps through to find the new frequency.

The bandwidth of the receiver is important. The satellite transmits a narrow bandwidth signal, so only a limited set of frequencies can be transmitted, but this is sufficient for the telemetry. The advantage of a narrow bandwidth is that the signal is less prone to interference. The receiver also has to have a similar narrow bandwidth, otherwise it will pick up a lot of interference which will distort the signal. Most scanning receivers are switchable between narrow and wide bandwidths, and are quite suitable for UOSAT.

More care and information is needed before a scanning receiver can be used with weather satellites, as receiving these signals is not so straightforward.

Scanning receivers are expensive, but they do open the door to receiving many other satellites. Until recently, one of the most famous satellite tracking stations was run at England's Kettering Grammar School. During the early years of the space race, boys at the school were often able to pick up and track Russian satellites. By measuring the Doppler shift of the radio signal carrying the satellite telemetry, they were able to work out its orbit and, often, where and when the satellite had been launched. Subsequently, the boys monitored the speech channels of Russian manned space flights — indeed, they were once the first people to report a Russian space accident.

Most amateur radio equipment manufacturers offer VHF scanning receivers. The AR2002 from AOR costs about $800 and is widely available. This scanner provides excellent value as it has a staggering coverage (25-550Mhz and 800Mhz-1.36Ghz), excellent sensitivity and very few internally generated signals (called 'birdies').

The most superior scanner is the ICOM IC-R7000. This tunes from 25-1000 Mhz and 1025Mhz-2000Mhz, high enough for it to receive signals from Meteosat 2, the geostationary weather satellite, but at almost $2000, it's rather pricey.

Most of these receivers offer a computer control interface which helps extend satellite tracking activities. Leaving a tape recorder connected to a receiver works well enough. The receiver is set to continually scan a range of frequencies; each time the receiver finds an active frequency, it stops, turns on the tape recorder and records it, stopping when the signal passes. However, it becomes very difficult to identify the source of the signal when the tape is replayed, as there is no record of the frequency or the time at which signals were received. Using a computer-controlled receiver, a log of all these factors can be kept and compared over a long period of time. With this, it is sometimes possible to identify the satellite.

At the top end of the range Icom's R7000 can have an optional speech synthesiser fitted so that it can announce the frequency being monitored. This is recorded on the tape along with the signal being received.

These scanning receivers offer a far wider frequency range than is really necessary in order to listen in on most satellites — remember, UOSAT 1 and UOSAT 2 transmit on 145.825Mhz. Another less expensive alternative is to fit a converter to an existing HF shortwave receiver. The converter changes the signal coming down from the antenna so that it will fit into the frequency range of the receiver. Some receivers, such as the Kenwood R2000, can have a converter fitted internally. When the converter is switched on, the frequency display is changed to show the correct numbers. Many of the newer short-wave receivers have scanning facilities and computer control interfaces built-in, enabling them to offer similar features to the more expensive VHF scanning receivers.

Information decoders

Whatever your receiver and antenna, if the system isn't a specialist one, you will

```
*****************************************************************************
* Sat-Pack:  UoSAT-2 RAW TELEMETRY FILE DISPLAY    [ Press <ESCAPE> to exit. ]
* Reading from file: R.TEST-2                      [ <SPACE> to toggle pause. ]
*****************************************************************************
 Y70104128
 00506301468B02673003348C04052305039F06025107052008047B09037D
 10293911332212000313063714135215440416181F17516418491519539 7
 20470121184E22660023000124000625000726097A27556328511F295248
 30513431040632286D33579B34000735264636317037430338476E39504B
 40765041120642642643061044166145000146000247494A48506F494779
 50563511027526753533308D54649A55000056000357499658494459506F
 60826A615BE7621F4E633305644402651705647ED6770066800OE69000F
 !UOSAT-2              8510270104133
 00505001478A02673003349D04052305039F06025107052008047B09037D
 10295F113322120003130637141291544041618 1F17515718486319539 7
 20443121184E22660023000124000625000726097A27556328512D295248
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 10298211332212000313063714125315441516181F17514618482719539 7
 20421521183922660023000124000625000726097A27557228513D295248
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 2037BE21184E22660023000124000625000726097A27557228515B295248
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 30512531040632286D33579B34000735269B36321537430338476E39504B
 40767241120642642643064544167045000146000247494A48506F494768
 50583B5110275268185368 7F54662355000056000357500758494459507E
 60826A615BE7621F4E633305644402651705664B2E6770066800OE69000F
 !UOSAT-2

                    <<<<<  END OF RAW TELEMETRY DATA FILE  >>>>>
```

Fig 7 An example of raw telemetry

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have to use an information decoder to interface the audio tones to your computer. An English organisation called Amsat UK supplies a simple kit for this purpose, plus lots of information about amateur satellites. Amsat has been set up to help amateur radio enthusiasts who use satellites to communicate on a world-wide basis.

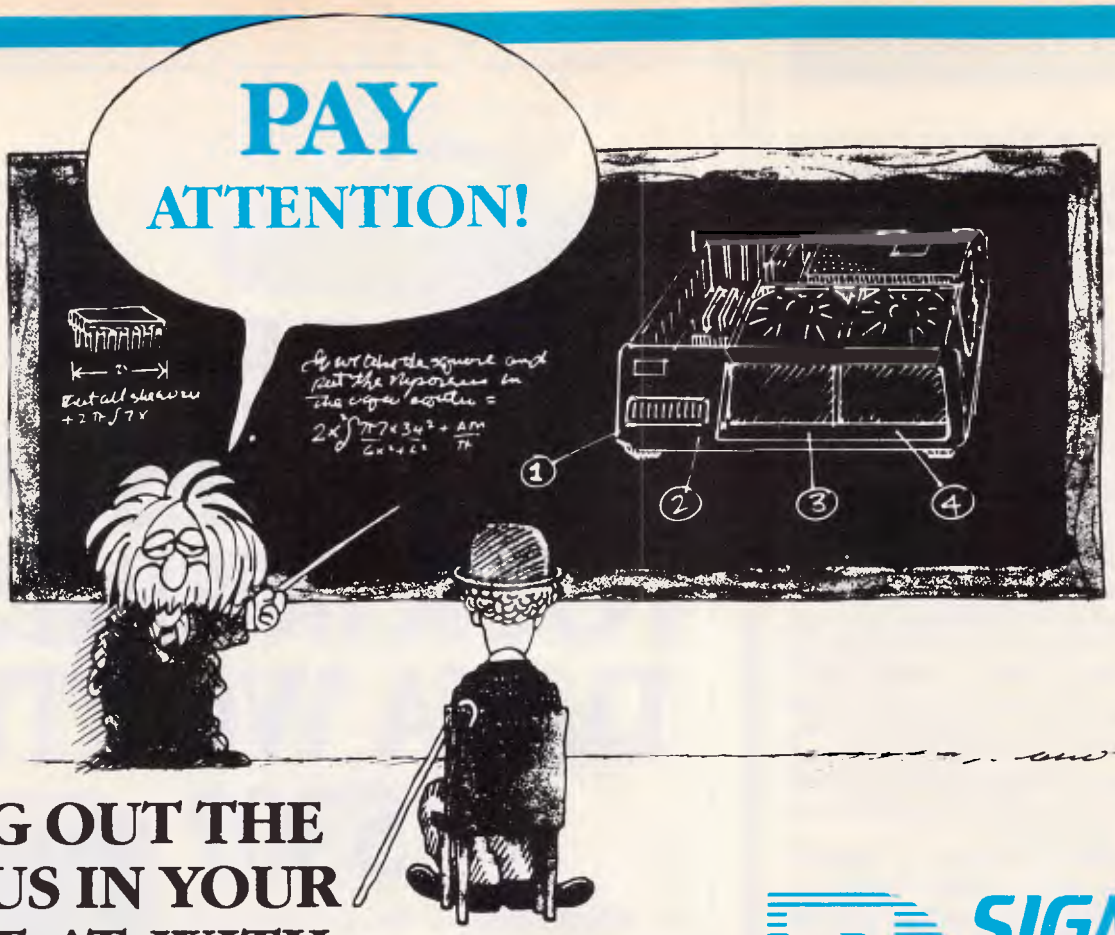
To get the most out of the university of Surrey satellites, you must receive UOSAT 1 and UOSAT 2, but this is no problem as they both transmit on 145.825Mhz. All the available decoders are capable of handling information from either satellite. The most interesting experiments are carried onboard UOSAT 2; they operate according to a schedule worked out by the command team at Surrey University. The team prepares a 'space news bulletin' which gives general-interest material as well as the operating schedule of UOSAT 2. This newsletter is also carried by UOSAT 1, so it is necessary for you to receive it to find out what the weekly timetable is for UOSAT 2 experiments.

The decoders produce an RS232 output, so any computer running a communications package can decode the signals. However, apart from the news bulletin, the telemetry comes as a whole string of numbers. These numbers give details of the 69 satellite functions, most of which deal with the spacecraft's system. It is possible to decode these numbers using the *UOSAT Handbook* from Surrey University, but this takes a long time. Occasionally, the satellite transmits telemetry by voice using a voice synthesiser, but this isn't particularly useful as it only manages to say a few figures before going out of range. The best method is to get a computer to decode it for you.

SATPAK

In Britain a software package called SATPAK has been developed. It is disk-based and comes in three parts. It is only available for the BBC Micro, and was written by Craig Underwood and Eric Twose at Scarborough Sixth Form College. The package is marketed by an English company called Unilab (which is also developing a UOSAT receiver), and can be obtained from that company or through Amsat UK.

SATPAK 1 is an orbital prediction system. The system takes standard Keplerian orbital data and uses it to plot the position of a satellite for any time and date (Kepler was an early astronomer who worked on the orbit of the planets). It will work with any satellite for which the relevant data is available, and there is an option in the system which allows this



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data to be entered and stored on disk. SATPAK 1 comes with data for UOSAT 1 and UOSAT 2, and a number of other satellites. The system is menu-driven to allow the selection of relevant drives and data entry sections. The main program allows you to specify the time, date and period during which you wish to see the path of the satellite; it also lets you set the time interval in minutes for each position to be shown.

When you have entered all these parameters, SATPAK 1 offers you the choice of showing the satellite's position as a list of numbers or plotting it as dots on a choice of maps — you can select a world mercator, a north or south polar map, or a map of Europe. On the latter, the time at which the satellite passes directly overhead is printed onto the screen.

Looking at the paths of different satellites is very interesting — one of the amateur radio satellites appears to move backwards at one point. It doesn't, of course: it's in a highly elliptical orbit which makes it appear to move backwards at some points in its orbit. This is useful for the radio enthusiast because the satellite stays in one place for a long time, allowing you to use it more easily. Comprehensive control over the timing elements is given via the BBC Micro's red function keys. It's quite exciting to let the system run in real-time with the receiver switched on — you can see its exact position at the moment of first reception. This is useful in the case of weather satellites, because when it's cloudy, it's sometimes difficult to discern exactly the subject matter of the picture. The satellite plot helps in these cases.

SATPAK 2 and SATPAK 3 are specifically aimed at UOSAT users. They are both concerned with the decoding and analysis of the telemetry data. SATPAK 2 takes the raw 1200-baud ASC11 signal and turns it into a complete annotated list of the experiments and their results, storing them on disk for later use.

There are five sections to SATPAK 2. The first two sections display and save to disk the raw satellite telemetry. The audio signal is fed in from the cassette recorder, or the receiver, where the software converts it into streams of numbers. The numbers appear in blocks, called frames. Each frame has a header which gives date and time information.

The third section is the heart of the system, and turns the frames into recognisable numbers. It uses clever routines to sort out valid data from corruption caused by interference.

This first stage of processing gives frames as recognisable groups of six figures. The first two digits give the

channel number; the next three give a hexadecimal value for the experiment; and the sixth is a special check-sum. The software takes a few minutes to completely reduce the raw data to readable results, and when this has been done, the data is displayed as fully annotated sets. Choosing either the analogue or the digital values produces a display onscreen of every channel — this can be sent to the printer for more detailed study.

SATPAK 3 is a graphing package which helps in the analysis of received data. It allows three data sets to be plotted against each other, using a variety of graph styles. It is possible to look for and study interrelated effects, either from different data channels of the same satellite pass, or the same data from different passes.

Uses of information

SATPAK 3's techniques relate to two major uses of the information gained. The first, immediate use is to try and discover exactly what the satellite was doing during its pass. You can't see it — the only information available is in its telemetry. This gives information about the temperature of the satellite's faces, the current in its solar panels, the horizon sensor, and much more. From this type of data it is possible to work out the satellite's orientation in space — details such as which side is facing the sun or the earth, is it spinning, and so on.

The second use is in long-term experiments. The satellite sends back masses of information, but it is only through long-term observation that changes can be detected. It is possible to conduct real experiments using this data; for example, it would be interesting to see how sunspot activity affects the earth's magnetosphere. Early in 1986, there was a solar storm that completely disrupted radio communications on the short-wave. It would have been interesting to look at the effect on the magnetosphere, which had been measured by UOSAT's instruments during this incident, but it would only be possible to see any change from normal if there had been a sufficiently large collection of data from other orbits to which the change could be compared.

Conclusion

Genuine scientific experiences can be gained from the information retrieved from satellites — the amateur scientist rarely has access to the kind of mass data which professional scientists have to deal with. UOSAT provides this access, along with all the problems of handling it and searching for hidden stories. It is not surprising that educationalists have begun to encourage UOSAT use in schools. In Britain an organisation called the Satellites in Education Project has been set up to help in this matter.

Whether it is just the excitement of listening to a satellite signal as it passes overhead, or a desire to carry out a genuine piece of scientific research, UOSAT 1 and UOSAT 2 are worth experimenting with. The next generation of software will decode image information from the CCD cameras on these satellites. The 'Big Brother' watching us may soon be our neighbour's micro!

END

Addendum

In Tune Into The Airwaves, the first article in this three part series, we told you how to receive teletype services. Below is a list of relevant services and their frequencies.

Agence France Presse (AFP)
7.542, 10.730, 19.327

Central News Agency (CNA) — Republic of China
7.695, 13.563

Reuters
6.845, 9.120, 10.960, 14.514

Tass (Official Soviet News Service)
6.870, 6.950, 7.760, 9.110, 10.270, 11.470, 12.085, 13.410, 14.510, 14.700, 15.923

United Press International (UPI)
9.985, 16.233, 19.520

Voice of America (VoA)
14.527, 19.793, 20,482

Xinhua (New China News Agency)
7.250, 9.491, 11.680, 12.265, 14.923

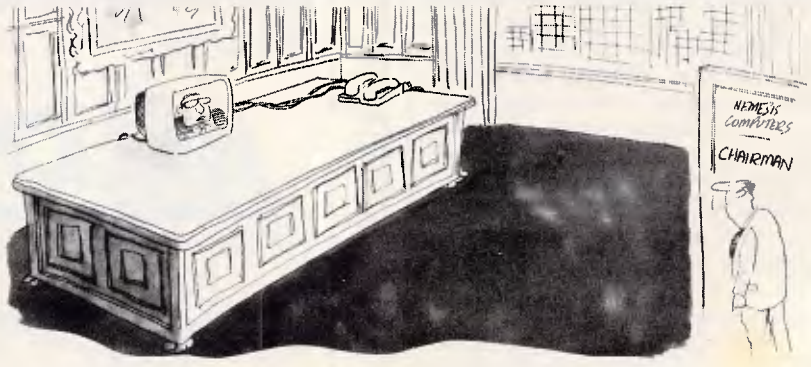
KCNA (North Korean News Agency)
13.780

Interpol (Organisation Internationale de la Police Criminelle (Interplod))
18.190

'Lucky Dip' frequencies: Some in French.
15.925, 16.099, 16.107, 18.263, 20.080

Note: All the above frequencies are used at different times of day. If they can't be received in the evenings, it's worth a try at other times of day. The frequencies given are approximate. Many teletype stations vary their frequencies up or down one or two kilohertz depending on conditions.

Happy listening!



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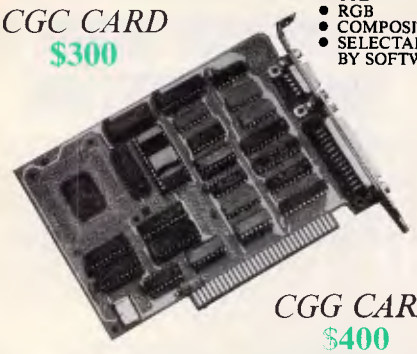

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Laserbase

Laserbase is a free-format, small-business database which aims to help the Atari ST gain some recognition in the business system market. Nick Walker looks at what it has to offer.

While there is no doubt that the Atari ST offers extremely good value for money, it is placed a little awkwardly in the market in terms of price. At around $1695 for a mono system, it is too expensive for most home users, and the business community doesn't trust a machine which costs so little from a company that once produced video games.

This uncertainty has meant that serious business software has been slow to emerge, which is a shame, as the machine certainly has the power to run such applications. One of the earliest business applications written for the ST was Laserbase from Laser Software. Laserbase is a free-format database which was originally designed for the Apple Macintosh. With its subsequent release on the ST, I thought I'd look at the package in more detail.

Design

In order to write this review, I decided to create a simple patient record system, such as may be used in a health clinic. It proved to be an interesting exercise.

Laserbase consists of three separate programs: a design program; an input program; and a reporting program. To create a new database, you must first run the design program, but before doing so, I strongly advise you to sit down and carefully plan exactly what data you want to store, how it will look on the screen, and how you will want to access it. Write everything down explicitly, and refer to your notes throughout the design process.

Running the design program will lead you to a screen which strongly resembles that of MacPaint and all its clones. To the left of the screen, there are a number of icons which represent the various design tools available, and the rest of the screen is a blank area upon which you design the layout of a record. The technique for designing a record is one which will be familiar to all users of a WIMP (Windows, Icons, Mice and Pull-down menus) environment. You select the type of field you require from the icons on the left, and use the mouse to define a box in the blank area which will represent this field. For fields of variable length, a numeric figure in the left-hand corner of the field automatically changes as you define it, giving you instant feedback on the size of the field. Every field defined in this way generates a prompt box, asking you to give the field a name.

All the standard data types — Text, Numeric, Data, and Time — are supported (I particularly like the rubber stamp icon which is used when selecting either data or time). In addition to these four, it is necessary to specify one, and only one, key field which will be used to index the file. I was disappointed not to see a Boolean or Yes/No field among the collection.

The most powerful of the Laserbase items is calculation. Calculations can be defined for numeric, data and time fields in an extremely simple manner. Selecting the calculation icon brings up a box containing a four-function calculator and a list of the fields available for calculation. Using this calculator, you can define any mathematical relationships between fields, subject to the usual mathematical restrictions such as too many brackets, recursive calculation, and too complex calculations. My version of Laserbase didn't have calculations on text as an option, though I understand that it will be standard on later versions.

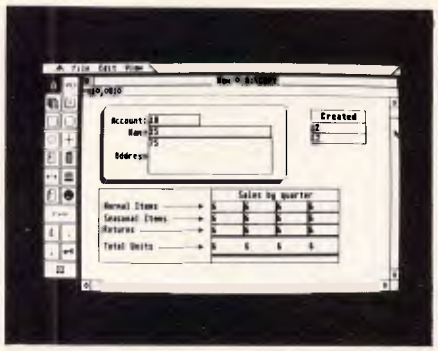
Having defined a record, a number of facilities are available to add emphasis and generally enhance the layout. Four outlines are available: squares, rounded squares, ellipses, and cross-hairs, in a number of line thicknesses. These shapes can be shaded, and text can be entered in a variety of formats.

My first impression of these cosmetic extras was that they were of limited use. It was a little later, when I was about to print-out a record, that I realised that you may want a company name on an invoice/order — or, in my case, a Health Authority's name on a patient's record. These facilities are ideal for this purpose, and are rarely found on most larger, more powerful databases. When the design is finished, you save it to disk and proceed to the second program — data input.

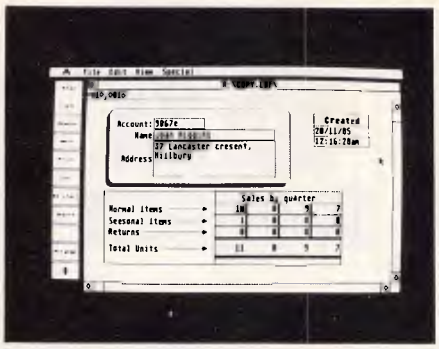
It is worth mentioning at this point just how easy a Laserbase record design is to modify. Many systems will take hours copying files into the new format, while Laserbase just takes you back to the design screen where you can add extra fields, delete current fields, or change the size of fields — all with very few restrictions. The key field must, however, remain completely unchanged.

Data input

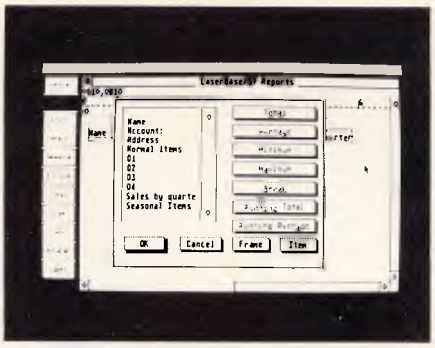
Having designed your record format, the next stage is to insert data into the database. Considering how much time



During the design process



Input design is vital



Onscreen report design

could be spent performing tedious, repetitive typing, the design of this part of a database is vital — any small problem can be magnified several times later on. Overall, Laser Software has done a good job by adopting the 'type as little as you can' approach.

For example, just type the day into a data field, and Laserbase will take the month and the year from the system clock in the ST. While this means that the typing effort is minimal, it also means that data validation is minimal. No ranges can be set up by the user, so the only data validation is done by the program on date and time. For the experienced user, the alert boxes which appear when data is incorrect can be switched off.

Although the input program is called 'LBINPUT', it is also used for record updating and simple sorting and searching. The left-hand side of the screen presents a row of symbols, or buttons, which represent the most common operations in searching and updating a database. These include: read record with specified key; save record with specified key; recalculate all calculation fields within a record; and delete record.

One of these buttons, the Arrange button, brings up a window which allows you to formulate a search request for the database. The search statement can be typed into this window in something approaching natural English. By enclosing the field names in square brackets, the system doesn't require any clever parsing technique to understand the request. An example search request would be: 'Accounts whose [fourth quarter] sales are greater than 5000'; or 'Patients whose [number of visits] is less than 3'.

Laserbase has a comprehensive initial dictionary of keywords which includes all the standard logical functions, plus such extra niceties as 'Starting with', 'Ending with', 'Containing' and 'Sort descending'. I'm assured that a utility will be made available to allow you to add your

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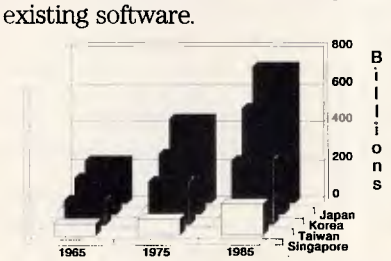

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own keywords to this dictionary, or to customise the existing ones to your own personal preference.

One particularly nice feature of the Arrange window is a button labelled 'OK', which performs a syntax analysis on the search statement and points out any errors. I can't really comment on the speed of such a search as I don't have sufficient knowledge of other databases, but I suspect that the search becomes excessively slow at a certain point (the actual number of records varies according to the size of each record).

I was quite alarmed when the disk drive whirred of its own accord in the input process, even when I hadn't touched the keyboard, and it wasn't until I read the manual that I discovered the reason. Laserbase automatically performs a periodic save on any database if the keyboard is in use. Personally, I would have found more helpful a message alerting me to the fact that I hadn't saved my data in the last 10-15 minutes of typing.

Reporting

Having spent a considerable amount of time and effort designing and entering information into your database, you will want to print a report. This is the function of the Laserbase disk's third program, 'LBREPORT'. Laserbase provides some powerful reporting facilities, the most obvious of which is onscreen report design.

The report program uses 10 onscreen buttons which are selected with the mouse in the normal point-and-click way, and provides a blank area for your report. The buttons' 10 functions can also be accessed by the ST's 10 function keys.

The first step in producing any report is to design it. Click the Design button and you will be presented with a menu giving six formats for your report. Only three of these — List, Column and Label — are available at the moment; the other three — Letter, Document and Disk — will presumably be available on a later version.

The Fields option will list all the fields from the database which are being used to generate the report. These can be selected and placed anywhere on the report screen in the same way as the Laserbase design program; the only difference is that you have much finer control over where an item is printed, and better labelling facilities.

All the other facilities you would expect from a decent database are there, along with more unusual ones such as: six mathematical functions applied to a single field; break lines in a sorted listing (to separate groups of orders by customer name) and headers and footers on list reports.

One Laserbase feature which runs across all three programs is a simple three-level password security scheme. Three passwords can be attached to any database: specifying the first password lets you look at a database and produce a report; specifying the first two passwords lets you read and modify the database; and specifying all three passwords allows you to do anything, including changing the design of the database. While this scheme is by no means totally secure, it should deter most part-time hackers.

Documentation

A pocket-size, 80-page manual is included with Laserbase, and doesn't do justice to the power of the system. It could be argued that a comprehensive manual is unnecessary with such a friendly system, but my experience suggests that this isn't true, and there are times when *nothing* substitutes for a good manual. It would also help to have examples on the disk with a product like Laserbase, but sadly, there are none.

Prices

The Australian Atari distributor, Mobex, is currently negotiating distributorship of Laserbase. No definite price has been set to date, however, Laserbase is expected to retail for approximately $229.

Conclusion

Laserbase is an excellent light-to-middle-weight database, which is ideally suited to small-business use for customer accounts and ordering. Excellent use is made of the WIMPs environment, making Laserbase ideal for those already familiar with the WIMPs style.

As far as the ST is concerned, Laserbase is a step in the right direction and an excellent early business application. If other manufacturers produce applications of a similar quality, the machine should soon be considered alongside the Macintosh and the IBM PC as a capable business system.

Mobex can be contacted on (02) 406 6277.

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Graphic design

Don't let the Amstrad PCW8256's lack of graphics commands deter you — graphic output is possible, using GSX routines. RS Gilmore explains.

When I saw the reviews of the Amstrad PCW8256 I decided to buy one, principally as a word processor, but also as a computer which would allow me to do simple mathematical modelling. The Mallard Basic which comes with the machine is fast and can store data in random access files. Furthermore, if you use the speed of the memory disk, and the chain merge facility, you can even run overlaid programs. The big disappointment is that the Basic has no graphics commands. This is a pity, as although I can accept being unable to play Space Invaders, I do want to display data in graphical form. I find that a graph is always much easier to understand than a sheet of numbers.

The software which comes with the PCW8256 includes GSX, the Digital Research Graphical System Extension for CP/M, and on page 59 of the CP/M+ section of the Amstrad manual there are some rather nice samples of graphical output which GSX has produced. The manual is a little vague about details, but in fact it is possible to use the GSX system from within Mallard Basic.

The GSX system

The GSX routines have a general resemblance to CP/M. In the CP/M system there are three components: CCP, BDOS and BIOS. CCP (the Console Command Processor) interprets the commands typed at the keyboard and passes them on to either BDOS (the Basic Disk Operating System) or to BIOS (the Basic Input Output System); BDOS controls the disk files, reading or writing data as required, while BIOS communicates with the keyboard and the printer. The system is designed to hide from the user all details of the hardware concerned. Any output from a program will have the same form whether it is sent to the monitor screen or to the printer. In the GSX system, the main sections are GDOS (the Graphic Device Operating System) and GIOS (the Graphic Input Output System). GIOS consists of the device drivers which control the output to the screen or printer; GDOS accepts commands from the user's program. It has the task of making all the output devices look the same whether you are using the screen or the printer (or, apparently, an HP plotter if you have one: there is a driver for that, too).

'Although I can accept being unable to play Space Invaders, I do want to display data in graphical form. A graph is easier to understand than a sheet of numbers.'

The printer output is rather slow, particularly in its high-resolution mode. However, the resolution of the printer in this mode is 960 × 1368, and I understand that the main use of GSX will be in producing printed plots; even so, the screen output is useful. It is an unfortunate fact that my first version of any program usually contains a few nasty surprises, and I don't want to produce pages of slowly-printed rubbish while I put them right. Consequently I use the screen for debugging, as I can see everything drawn there as the commands are sent. When the results are satisfactory, a copy can be produced on the printer using the same commands, which ought to work. You do have to be careful with this approach, as the screen will not display many of the options which are available for the printer. Figs 1(a) and 1(b) show the results of sending the same commands to the printer and to the screen. The positions and shapes of the various components are the same, but the effect is quite different.

One problem with GSX is that it takes up a lot of memory. BIOS and BDOS are tucked neatly away to leave you with a TPA (Transient Program Area) of about 61k. After the Basic interpreter is loaded, this still leaves about 31k for you to use. Unfortunately the GSX routines also sit in the TPA, so they are competing with you for memory. They are quite large programs, too — the high and low-resolution printer drivers are 15k and 12k respectively; consequently, only one device driver is loaded at any time. When you want to change between different output devices you must load a new driver, but if the device drivers are kept in the PCW8256's RAM disk, this doesn't take very long.

Fig 1(a) A picture using fill techniques as output on the printer

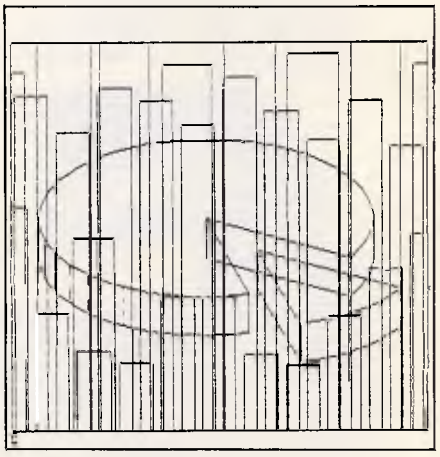

Fig 1(b) The same picture as 1(a) but as seen on the screen

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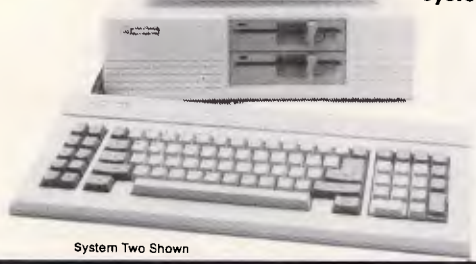

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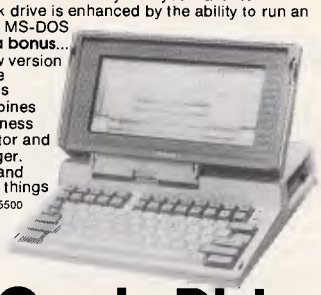

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```
Z80 CALL to location #0005
      C register contains number 115 (#73)
      DE register pair contains address, (DE), of Parameter Block

The Parameter Block contains
      at location (DE)    [address of array CONTROL%]
                  (DE)+2  [address of array PAR.IN%]
                  (DE)+4  [address of array COORD.IN%]
                  (DE)+6  [address of array PAR.OUT%]
                  (DE)+8  [address of array COORD.OUT%]
```

Fig 2 GSX calling conventions

Loading the utilities

To save further space, the GSX routines are only loaded when you require graphic output, unlike the CP/M+ resident routines which are always in memory (except when you are running Locoscript). Fortunately, the routines are easy to load; the process is described on page 62 of the Amstrad CP/M+ manual. You first have to make sure that the files you need are available on disk. The files needed are GSX. SYS, ASSIGN. SYS, DDSCREEN.PRL, DDFXLR8.PRL, DDFXHR8.PRL and GENGRAF.COM, which are all held on side four of the disks which come with the computer. You also need the program which is to produce the graphical output, which in this case is the Mallard Basic interpreter, BASIC.COM; this is on side two of the disks. They can all be copied onto one disk using PIP, as described in section 2.3 of the Amstrad manual. When you have the files available, and are running CP/M, type GENGRAF BASIC. This will attach GSX to the Basic interpreter — it's as easy as that. You can now delete GENGRAF.COM, as it has no further use.

From now on, when you load Basic, a message about 'GSX-80' will appear before the usual 'Mallard-80 Basic with Jetsam'. You will also have 17258 bytes of memory instead of 31597. Where has all the memory gone? Mostly, it has been filled with a device driver. GENGRAF attaches a short loader to the start of BASIC.COM, and when you attempt to load Basic, you actually run this loader. It first brings GDOS and one device driver into memory, then it alters the link address at memory location 0005 so that all system calls are filtered through GDOS. Finally, it loads Basic at the normal location. The device driver which it chooses to load is controlled by the file ASSIGN.SYS, which is a text file so it can be altered. The usual form is given below (the extension .PRL is assumed in this file):

```
21 @:DDFXHR8
22 @:DDFXLR8
11 @:DDHP7470
01 @:DDSCREEN
```

This file gives the logical device numbers by which the system knows the different device drivers. Starting from the top of the list, the drivers are for the printer in its highest-resolution mode; the printer in low-resolution mode (roughly equivalent to the draft mode for text); a plotter; and the monitor screen. The driver at the top is the one which the GSX loader will bring into memory when you load your new version of Basic. Enough memory is allocated to hold this driver, but no more, so it is important that this should be the largest driver that you plan to use. You could have more space available for Basic programs if you put the screen driver DDSCREEN at the top of the list, as this is only approximately 4k long, but then you would be unable to use any device *but* the screen as the other drivers would overwrite part of the system.

The great reduction in the amount of usable memory does seem a pity, but on the PCW8256 it is not quite the disaster it might be. There are two ways of overcoming the space restriction by using files stored on the RAM disk M for fast access.

One way would be to write your program to calculate the data which you wish to display, but to run it with a version of the basic interpreter which does not have the GSX utilities attached and consequently still has 31597 bytes of free memory. Instead of producing any graphics directly, the output data could be stored in a sequential file. It would subsequently be read back by a simple program running under a version of the Basic interpreter which does have GSX attached; this need do no more than display everything that it reads, and could be very short. Such an approach has the drawback that, when you are developing a program, you would not be able to see any graphic output on the screen while the program is running.

Mallard Basic allows a second possibility for dealing with the reduced memory space, which is to split your program into small pieces and use an overlay scheme. If your program can be divided into distinct sections which are run in sequence, then these can be stored in separate files, and each can load the next with the Chain Merge command. This has options which allow you to delete sections of the previous routine before the new one is loaded, and to preserve some or all of the variables in use. Any arrays which are no longer required can be removed with the Erase command. This approach was used to create Fig 8, for which the shading routines became rather lengthy.

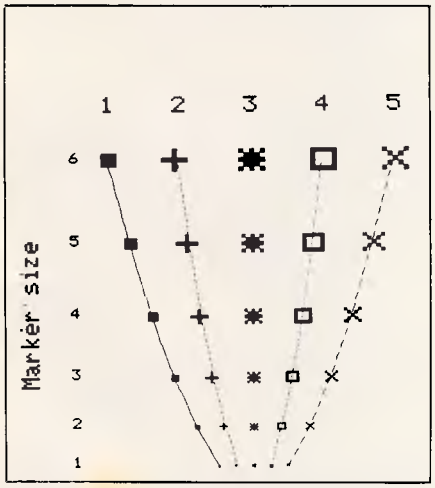

Fig 3 Line and marker styles, with different marker sizes

Calling the utilities

The GSX utilities are called in much the same way as any of the CP/M system functions: that is, by a CALL to the memory location 0005, with a function number held in the Z80 C register and any other information passed through the DE register pair. Any call with the function number 115 (hexadecimal #73) is accepted by GDOS, and all others are passed on to CP/M.

The number of options available with GSX is rather large. The version on the PCW8256 does not implement them all, but there can still be a lot of information to pass to GSX when a call is made. This is achieved by using the DE register pair to hold the start address of a 10-byte parameter block. This block in turn contains the start addresses of five arrays of 2-byte integers which actually contain the information to be passed between GSX and the calling program. The scheme is summarised in Fig 2.

You may note that there are arrays for both input and output information. The arrays PAR.IN% and PAR.OUT% hold information which specifies how the GSX routines are to respond. The arrays COORD.IN% and COORD.OUT% hold the x and y coordinates which give the horizontal and vertical positions of a

Fig 4 Repeated forms, as used in pictorial unit charts

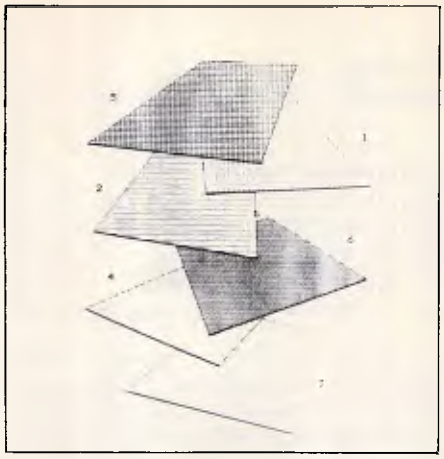

Fig 5 The 'hatch' fills available

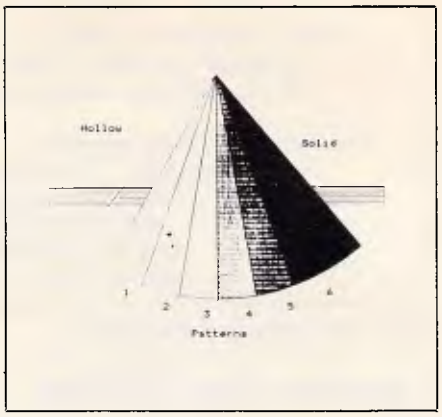

Fig 6 The different densities of grey tones available

number of points in the sequence x_1, y_1, x_2, y_2, . . .

In general, the input arrays tell GDOS what you want to do, while the output arrays allow GDOS to tell you what has actually been done. These may not be the same, as the loaded driver may not be able to perform the operation you asked for, or the position coordinates may vary slightly from those you sent due to the limited resolution of the output device. You can request any defined GSX operation from any device driver without generating an error, but some requests will be ignored. There are many options available for the printer which are not possible on the screen; these are summarised on page 65 of the CP/M+ section of the Amstrad manual, and I will describe them in more detail later.

In Basic you can define explicit integer arrays, with names ending in '%', which will store numbers in the 2-byte integer form required by GSX. These should be dimensioned as follows:

DIM CONTROL%(5), PAR.IN%(79), COORD.IN%(1,74), PAR.OUT%(44), COORD.OUT%(1,74)

The dimensions used in each case assume that you do not use OPTION BASE 1 in your program. This makes index 1 the first element of an array, whereas the default is that arrays start with index 0, so that CONTROL%(5), for example, will contain six elements.

In Mallard Basic, there are two means of calling external routines; one is the USR function. This can have only one parameter, and that is not, in general, passed to the routine in the DE register pair as is required. I have no doubt that the USR could be used to make GSX calls if there were no other way, but the Call command is more convenient. This has the form: CALL *addr* (P_1, P_2, P_3, P_4 . . .). Here, *addr* is the start address of the external machine code routine, and the parameters P_1, P_2, and so on, are variables passed by reference. That is, the addresses of the variables are sent to the external routine. The specification is that:

— the address of P_1 is passed in the BC register pair;

— the address of P_2 is passed in the DE register pair;

— and, if there are four or more variables, the remainder are passed in a parameter block whose starting address is given in the HL register pair. This all looks a little like the specification for GSX calls, but unfortunately it is not quite the same.

There are two possible ways of using this command. One way is to declare a Basic array, GSX%(4), which will form the parameter block. If we make a Call of the form: CALL *addr* (dummy,-GSX%(0)), then the DE register pair will contain the start address of this block, as is required. The variable 'dummy' is needed because it is the *second* parameter which is passed in the DE registers. In this case, the array will have to be loaded with the start addresses of the five parameter arrays before the

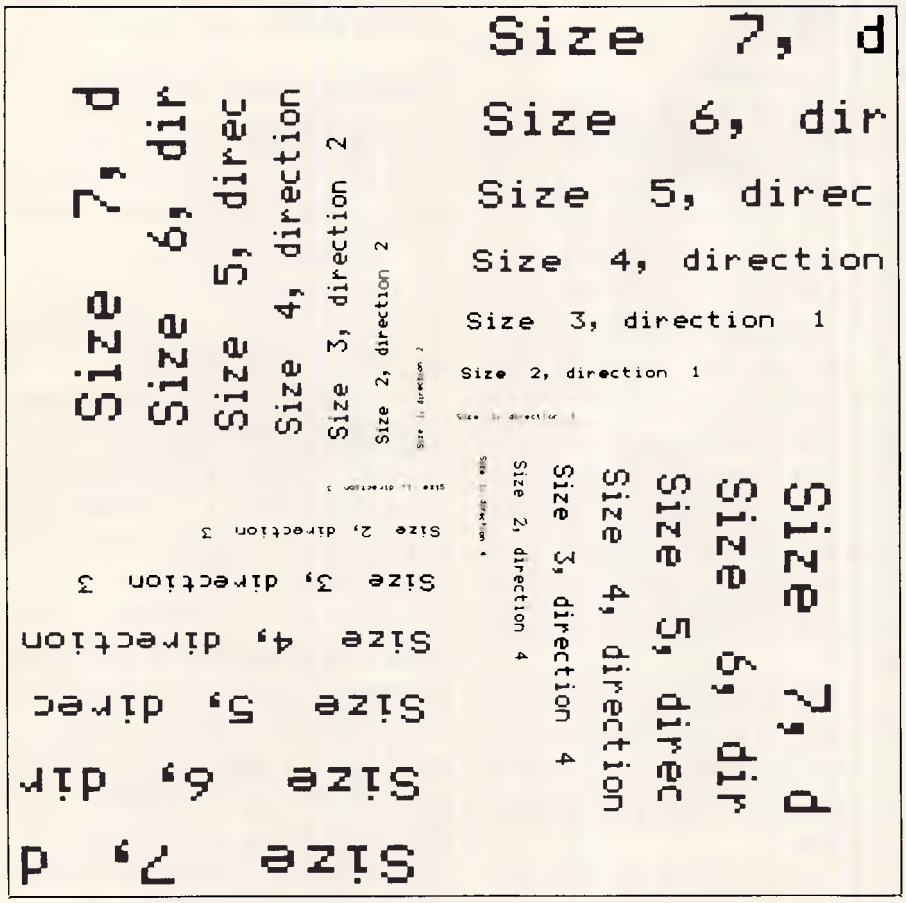

Fig 7 Samples of text sizes and directions

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CALL is made. This is possible as there is a Basic function, VARPTR, which will return the address in memory of any variable. The function returns the address as a single-length real number, which will be forced to integer form when it is assigned to an element of the integer array GSX%. However, integers can only take values between −32768 and 32767, so any addresses above 32767 would cause overflow. There is a way round this in the form of the function UNT (unsigned integer conversion), and a line of the form GSX%(0)=UNT-(VARPTR(CONTROL%(0))) will store an address of any size up to the maximum of 65535. A similar expression is needed for all five of the parameter arrays, including the two for output information. Although the contents of these arrays will be written by GSX, it is still necessary to assign memory for them so that they are not written at an inconvenient place (most probably at the entry point to CP/M if the address 0 were to be sent by default).

This allocation of the five addresses to GSX% is a little inconvenient, although it does have the advantage that coordinates for different graphic forms can be stored in different arrays, and the address of the required array can be assigned to GSX%(2) just before the call to the GSX routines is made. A problem can arise with this address assignment if any new variables are subsequently declared before the CALL. This is because array variables are held in memory above the simple variables, and if a new variable is declared, the arrays are moved up in memory to make room for it. In Basic, a new variable will be created anywhere in the program, each time it is mentioned for the first time. In particular, if the variable 'dummy' had not been mentioned before, it would be created just before the CALL was made. This would result in all the addresses stored in GSX% pointing to the wrong places. This problem is avoided completely if the parameter block option of the Call command is used. A line of the form: CALL *addr* (dummy, dummy, CONTROL%(0), PAR.IN%(0), COORD.-IN%(0, 0), PAR.OUT%(0), COORD.-OUT%(0, 0)) will make a call with the start address of the required parameter block held in the BC register pair. As you will probably have noticed, these are the wrong registers. To correct this the CALL must be made, not to the CP/M entry point 0005, but to a short link routine which transfers the contents of the BC registers into DE. Although this operation is not necessary for the first, aforementioned method for constructing the parameter block, it would still require a form of link routine. This is because

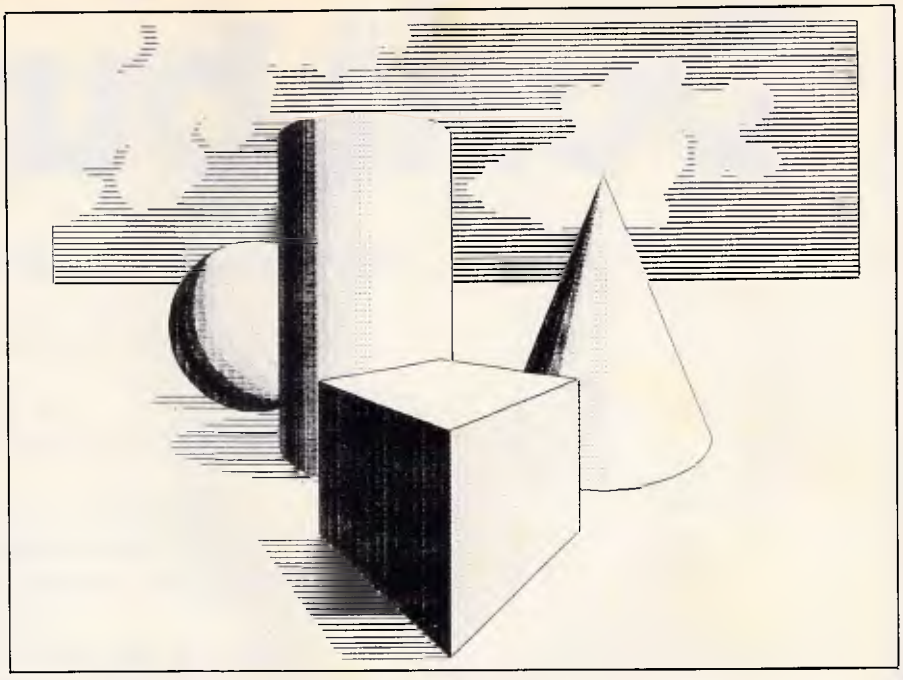

Fig 8 A demonstration of shading and masking effects

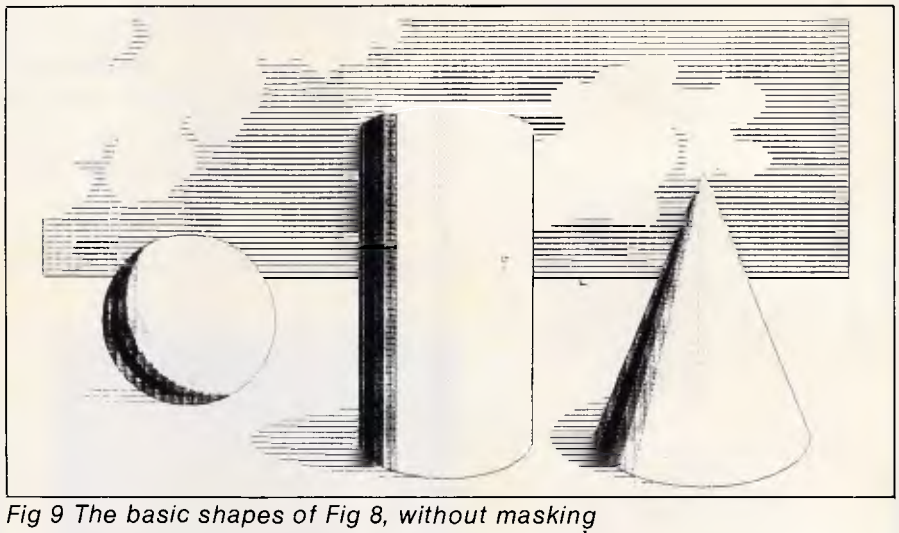

Fig 9 The basic shapes of Fig 8, without masking

GDOS will only recognise calls with 115 (#73) in the C register, and there is no obvious way of arranging this with the Call command, though it can be done quite easily with a short machine code routine such as:

```
LD D, B
LD E, C
LD C #73
JP #0005
```

The instructions listed below will load the necessary few bytes of code above HIMEM, the largest address which is available to Basic. Subsequent GSX calls may then be made to the location *addr*=HIMEM+1:

```
MEMORY HIMEM−7: REM create 7
  bytes for link routine
DATA &H50, &H59, &H0E, $H73,
  $HC3, &H05, &H00
FOR n=1 TO 7
READ glink
POKE HIMEM+n, glink
NEXT n
```

If the first method of making the calls is preferred, then the above code may still be used, but with the first two items dropped from the DATA list and the number 7 replaced by 5 throughout (though not, of course, in the number &H73 in the DATA list). On the whole I feel that the second method is safer. As the parameter block is set up within the CALL routine, there is no possibility of pointing to the wrong address for the arrays. It has the slight drawback that data passed to GSX must be held in the arrays named in the call. As all variables in Basic are global, there is no possibility of using dummy variable names for the

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Exit	MacWrite	4.0	14.0	3.5
Start	Microsoft	5.0	26.5	5.3
Exit	Word	7.0	32.0	4.6
Start	Microsoft	5.5	23.5	4.3
Exit	Multiplan	4.5	18.5	4.1
Start	Lotus Jazz	20.5	50.5	2.5
Exit	Lotus Jazz	8.5	20.5	2.4
			Average	3.5

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Function code CONTROL%(0)	FUNCTION	CONTROL%(1)	CONTROL%(3)	Other parameters needed.
1	LOAD new driver	0	10	PAR.IN%(0...9), as described in text.
2	CLOSE down driver	0	*	*
3	CLEAR picture	0	*	*
4	OUTPUT graphic buffer	0	*	*
6	DRAW line sequence	Number of points (n)	*	COORD.IN%(,0...n-1)
7	PLOT series of markers	Number of points (n)	*	COORD.IN%(,0...n-1)
8	TEXT output	1	Number of characters	COORD.IN%(,0) Text in PAR.IN%
9	FILL polygon	Number of points (n)	*	COORD.IN%(,0...n-1)
11	Draw BAR	2	*	Coord of lower L and upper R corner
† 12	setTEXT SIZE	1	*	COORD.IN%(0,0)=0 COORD.IN%(1,0)=size
† 13	set TEXT DIRECTION	0	*	Complicated (see text)
15	set LINE STYLE	0	*	PAR.IN%(0)=style
17	set LINE COLOUR	0	*	PAR.IN%(0)=colour
18	set MARKER STYLE	0	*	PAR.IN%(0)=style
† 19	set MARKER SIZE	1	*	COORD.IN%(0,0)=0 COORD.IN%(1,0)=size
20	set MARKER COLOUR	0	*	PAR.IN%(0)=colour
22	set TEXT COLOUR	0	*	PAR.IN%(0)=colour
† 23	set FILL STYLE	0	*	PAR.IN%(0)=style
† 24	set FILL INDEX	0	*	PAR.IN%(0)=index
25	set FILL COLOUR	0	*	PAR.IN%(0)=colour

* means no value need be set

† shows options not available on the screen

Table 1 The full range of available operations

arrays. If you want to use a different array, you would have to make a separate CALL in which it is named explicitly.

All the information sent to the GSX procedures is held in the arrays CONTROL%, PAR.IN% and COORD.IN%, the other two arrays being used by GSX to return information. The array CONTROL% passes numbers in both directions; its contents are defined as follows:

You set: CONTROL%(0) to the function code which selects the operation you want.

CONTROL%(1) to the number of points for which you have specified coordinates.

CONTROL%(3) to the number of integers which you are sending in PAR.IN%

GSX sets: CONTROL%(2) to the number of integers which are returned in PAR.OUT%

CONTROL%(4) to the number of points for which coordinates are returned.

Any further elements, CONTROL%(5) and above, have meanings which depend on the operation selected.

The range of operations available is shown in Table 1. You will see that a number of function codes have been omitted; this is either because they do not work for the PCW8256, or, as for the screen cursor control, it is easier to achieve similar results within Basic.

The functions may be divided into a number of groups, depending on the type of operation performed. The first group controls the start of the graphic device driver currently in memory.

Loading graphic drivers

The 'LOAD New Driver' function has the largest amount of diverse information associated with it of any operation. It requires 10 parameters to be sent which control the values of such things as the style of line used, the way in which areas are to be filled, and so on. Some of the operations controlled are not available on the Amstrad; those that are are listed below. Further details of the options are given in the description of the various 'SET' functions described later.

PAR.IN%(0) The logical device number
PAR.IN%(1) DRAW Line style (1...5)
PAR.IN%(2) Line colour (0 or 1)
PAR.IN%(3) PLOT marker style (1...5)
PAR.IN%(4) Marker colour (0 or 1)
PAR.IN%(5) Not implemented
PAR.IN%(6) Text colour (0 or 1)
PAR.IN%(7) Style of area FILL (0...3)
PAR.IN%(8) Index for area FILL (1...6)
PAR.IN%(9) Colour of fill (0 or 1)

Satisfactory results can be obtained by setting all of these equal to 1, apart from the first. If particular effects are required, they may be obtained with various SET commands. The first parameter is the driver identifier which is given in the ASSIGN.SYS file, so you would set this to 1 to use the screen, 22 for the printer in the low-resolution mode (similar to the Locoscript draft model), and to 21 to get high-resolution printer output. If the required driver is not in memory, and if it is on the default disk, it will be loaded. If it is already in memory, or if GDOS cannot find the right file, then the driver already in memory is retained.

Whether or not a new driver is actually loaded, this request returns no less than 45 numbers in PAR.OUT%, together with another 12 in COORD.OUT%. These give a selection of information about the facilities available, and some of it is rather useful. The numbers of particular interest are:

PAR.OUT%(0) The maximum width of the output in plotting steps: that is, the horizontal resolution.

PAR.OUT%(1) The maximum height: that is, the vertical resolution.

PAR.OUT%(3) The horizontal width of one plotting step in micrometres.

PAR.OUT%(4) The vertical width of one plotting step in micrometres.

COORD.OUT%(1,0) The minimum character height in device units.

COORD.OUT%(0,2) The minimum line width in device units.

COORD.OUT%(1,4) The minimum market height in device units.

These numbers are all useful in calculating the size of graphic output produced.

When the screen is used for graphic output, it would be a pity if any output messages were printed on top of the graphics. This may be prevented by setting a screen window so that all the messages appear on the bottom line of the screen, which is normally reserved for system messages. This may be done with the instruction:

PRINT esc$; "0"; esc$; "X"; CHR$(63); CHR$(32); CHR$(32); CHR$(120)

where esc$ has previously been set to CHR$(27), 27 being the 'escape code' which is usually written 'ESC'. The effect of this string may be found in Appendix III of the CP/M+ section of the

PCW8256 manual. ESC 0 disables the status line so that the bottom line of the screen may be used, while ESC X sets a text viewport. In this case, the viewport is the bottom line of the screen only. Unfortunately, the graphics output to the screen turns out to be confined to this viewport also, so before any graphics call which will use the screen, it is necessary to enable the whole screen with a command:

PRINT esc$;"H";esc$;"f"

ESC H moves the cursor to its 'Home' position at the top left-hand corner of the screen, and in the process cancels the window. ESC f disables the cursor blob on the screen (this is purely a matter of taste. I prefer not having it present when drawing graphics).

The remaining calls to control the device driver conditions are straightforward. You need only to set CONTROL%(0) to the function code as given in Table 1 and CONTROL%(1) to 0. The other array elements need not be set.

CLOSE down the driver: this finishes the use of the device driver in an orderly fashion, preventing any previous graphic commands from being lost.

CLEAR the picture: this prepares for a new picture, either by clearing the monitor screen or feeding a new page on the printer, whichever is appropriate.

OUTPUT graphic buffer: the screen and the printer differ in the way they respond to a sequence of graphic outputs. On the screen, each item is drawn as it is received, but the printer driver stores all the information until requested to print out the entire picture. The OUTPUT function makes this request; it has no effect on the screen.

The coordinate system

In keeping with the general philosophy of hiding the details of particular output devices from the calling program, the GIOS routines expect all positions to be expressed in terms of a coordinate system in which the horizontal, x, coordinate lies in the range 0-32767 and the vertical, y, coordinate lies in the same range. This ensures that as long as your coordinates remain in this range, the output will not fall off the edge of the picture — whichever graphic device you may be using.

There is one problem with a coordinate system which defines the output as 32767 units square, and that is that the output area is not, in fact, square. The screen is wider than it is high, while for the printer, the picture is higher than it is wide. This means that if you define a circle with equal x and y dimensions, for example, it will appear on the screen as a low, wide ellipse and on the printer as a tall, narrow one.

If you want your output to stay in the picture, you can use the entire coordinate range in either direction; but if you want shapes to have the correct proportions, you must scale the coordinates. This can be done using the information returned by the LOAD operation. If you multiply the resolution in each direction by the size of the plotting step, you get the actual width and height of the output area. To be specific, let's assume that we are using the screen. In this case, the width is calculated to be roughly 270 millimetres and the height as 198 millimetres. If the smaller dimension, the vertical in this case, is allowed to cover the full range of 32767 units, but the horizontal coordinates are reduced by a factor equal to the ratio height/width — that is, 0.73, then all output will appear in proportion.

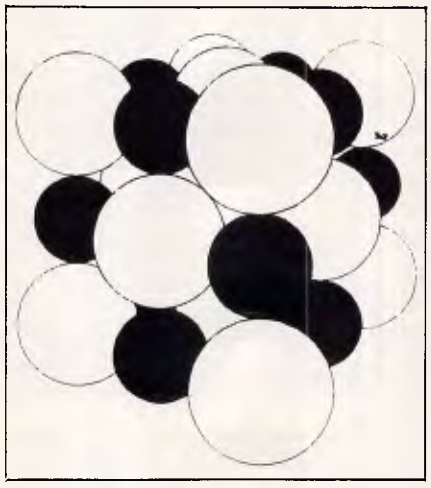

Fig 10 Extensive use of filled circles

Graphic functions

We come at last to the principal operations which actually produce graphics: these are DRAW, PLOT and FILL. Unlike the usual Basic graphic commands, these will deal with many points in one call — up to 75 of them. The coordinates which define these points are passed to GSX in the array COORD.IN%. For each function there is a variety of options, all of which may be selected with various SET functions. With these operations, you need to set CONTROL%(0) to the appropriate function code from Table 1 and CONTROL%(1) to the number of points to be used for the output.

The DRAW operation will draw a series of lines connecting successive points in the array. There are five styles available (six for the printer); these are illustrated in Fig 3. There is only one line width possible, despite the entry on page 65 of the Amstrad manual which states that there are 12 for the printer.

The PLOT operation will put a marker at each position specified in the coordinate array; these markers come in five different styles and in five different sizes. All the styles and the smallest six sizes are illustrated in Fig 3. There is only one size on the screen.

The FILL operation connects all the points together, much like DRAW. It then joins the last point to the first to make a closed polygon, which it fills in one of a variety of styles. It is not able to fill a shape created by a previous command, but as up to 75 points can be sent, it can generate a variety of shapes; a regular 72-sided polygon is a pretty good approximation to a circle, for example. Fig 10 makes extensive use of filled circles. Another example of the type of shape you can create is given in Fig 4, where one basic array has been used to generate figures of different sizes, such as you might use in a pictorial plot to illustrate statistical data.

There is also a function BAR which draws a rectangular bar, suitable for use in bar plots. This is filled with the same range of fill styles as for the FILL function. FILL could produce the same effect by giving the coordinates of all four corners, while BAR has the slight advantage that you only have to give the coordinates of two corners — the lower left-hand and the upper right-hand ones.

The choice of fillings available is impressive. You can have style 1, a solid filling, or style 0, a hollow filling where the area isn't filled at all. You can have six hatch styles (style 3) and six patterns (style 2). The hatches which you can have if you select style 3 are chosen by setting the fill index, a number in the range 1 to 6. Fig 5 shows the hatches available. The patterns which you can have in style 2 are again selected with the fill index and are shown in Fig 6, together with the hollow and solid fills. The patterns are, in effect, grey shades with a steady progression in density from white to black, and can give crude shading effects as in Figs 8 and 9.

Text output

As well as the aforementioned four functions which actually draw something, there is another which allows you to write captions, label the axes of graphs, and so on; this is the TEXT output function. For this, you set CONTROL%(0)=8 and CONTROL%(1) =1, while CONTROL%(3) contains the number of characters you wish to print.

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You must then pass, in the COORD.IN% array, the x and y coordinates of one point — the lower left-hand corner of the first character in the text string.

The text itself is passed in the array PAR.IN% and requires some consideration. The GSX routines expect to find one character in each 2-byte element of the array, while in Basic, text is held in string variables which hold one character in each byte. A further complication is that the address which Basic returns for a string, either when using the VARPTR function or in the CALL command, is that of the string descriptor. This is a 3-byte variable which specifies the number of characters in the string and the address at which the string itself is held. The simplest way of dealing with strings, which suits both suggested methods for making the CALLs to GDOS, is to copy the characters one by one from the string into the PAR.IN% array. This could be done as in the sequence below, where the text is assumed to be held in the variable TEXT$:

```
FOR ch = 1 TO LEN (TEXT$)
PAR.IN%(ch
  −1)=ASC(MID$(TEXT$,ch,1))
NEXT ch
```

After this you can set CONTROL%(3) =LEN(TEXT$), and the call to GDOS can be made in the normal way. With this method, the longest text line which you can print is limited by the length of PAR.IN%.

On the monitor screen, there is no choice as to the way in which text can be written, but on the printer you can choose between 12 text sizes, equivalent to the 12 different marker sizes, and four text directions. The range of options is illustrated in Fig 7, which shows the four directions and the seven smallest sizes. The ability to print text rotated at 90° intervals is obviously useful when labelling the vertical axes of graphs and plots. Text direction 4 was used in Fig 7, in which the horizontal and vertical coordinates were interchanged to allow the printer to produce a picture whose width is greater than its height, without any loss of resolution.

With this TEXT output function, all 256 character codes are treated on the screen as printable chracters, as defined in Appendix I of the CP/M section of the Amstrad manual. In particular, the codes 0-31, which are interpreted as control characters in the Basic PRINT and LPRINT commands, will appear on the screen as Greek letters and mathematical symbols. With a printer driver in use they are still not treated as control codes, but they do not print, either. The character set available for the printer consists approximately of the symbols you can get under Locoscript without using the Alt or Extra keys.

Setting GSX options

The final functions in Table 1 serve to select the various options available for the main graphic operations. Those which are not available on the screen are marked with a '†'. As with all functions, the function code is set in CONTROL%(0).

Firstly, there are the calls which set the style of the line, marker or fill used. They all have CONTROL%(1)=0 and the code for the style requested in PAR.IN%(0). The calls to set the fill indices have the same form.

The colour of the line, marker, text or fill can be set. Again, CONTROL%(0)=0 and PAR.IN%(0) are either 0 or 1. Colour 1 is the normal mode, which draws in black on the paper and green on the screen. Colour 0 will draw with the same colour as the background and can be useful for erasing.

Finally, there are the options for setting the text and marker size, and the format for these is rather different. In this case, CONTROL%(0)=1 and the size requested are passed in COORD.IN% and not in PAR.IN%. COORD.IN%(0,0) is set to 0, and COORD.IN%(1,0) is set to the size required. As this operation involves resetting the coordinates of the first point in the COORD.IN$ array, it can produce some dramatic effects for the next DRAW or FILL interaction if you are not careful.

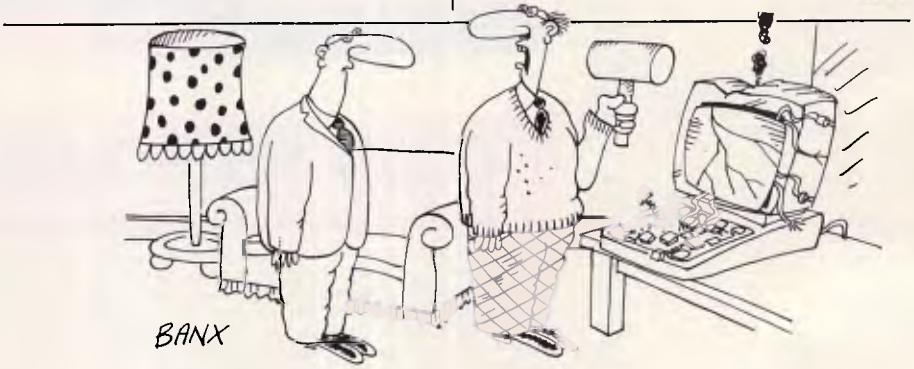
Writing mode

The drivers on the Amstrad appear to have only one writing mode, the Replace mode. For text on the screen, this mode behaves in the way in which you would expect a screen to behave — a new character will blot out a previous one in the same position. On the printer, in fact, the text mode is more like an OR mode. It is only the black regions of the letters which replace what is already there, so you can, in effect, overstrike.

Reverse colour

The Replace mode is really interesting in the effect of the FILL operation, where a hatch or pattern will replace whatever was there previously. This is illustrated in Fig 6, where a bar shape was drawn first and the superimposed triangles were filled with hollow, pattern or solid fills. You can see that the bar has been erased by all but the hollow fill. On the screen only the hollow fill is available, so you do not get this effect. This you can see by comparing Figs 1(a) and 1(b), which come from the same sequence of commands. On the printer, the pie shape has obscured the bar shapes which were drawn first. A white area like this cannot be produced by using the hollow fill, as this leaves the enclosed area as it was; instead, you have to set the colour to 0. This produces the effect of drawing with while lines on white paper, and is therefore a little difficult to see. If, however, you fill an area with any fill style *other* than hollow, it will remove whatever has been drawn previously. You can erase areas at will. This can give the effect of hidden line removal: that is, you can omit from a drawing any parts which would be obscured by something in front of them. If you draw the shapes furthest away first, then any filled shape in front which overlaps them will erase them from the overlap region. This approach was used for the different shapes in Fig 8, which were drawn in succession by different routines brought into memory, one after another. The obscuring effect may be seen by comparing Fig 8 with Fig 9, in which the shapes were separated so that they did not overlap and the entire shapes can be seen. The block was omitted in the last picture as there was not enough room to keep it clear of the others.

I hope that in this article I have managed to demonstrate that, although the Basic that comes with the PCW8256 does not have any graphic commands, it is possible, from Basic programs, to produce a wide range of graphic output using the GSX routines. END



'Frankly, it's the only language it understands.'

Lotustaradox

The word that Imagineering and Osborne created.

lōtto, n. Game of chance with drawing of numbers as in lottery. [It.]
lotus, n. The world's leading integrated spreadsheet program; commonly referred to as 123. [L. f. Gk lotos]
lotustaradox, n. The addition of Lotus, Wordstar, Paradox and the Osborne 2000 PC; commonly referred to as TRILOGY
loud, a. & adv. v. **1** Strongly audible, sonorous (*speaker*, *trans.* apparatus that converts electrical impulses into sounds enough to be heard at some distance); clamorous, noisy; (of colour, dress, pattern, manners) obtrusive, conspicuous, flashy; hence EN[6]

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Hackers stop here!

Not everyone sees hacking in an unfavourable light: the author of the new Hacker's Handbook, for example, regards it as 'a recreational and educational sport'. Peter Tootill and Steve Withers report.

The second edition of the *Hacker's Handbook* has just been published. The first caused quite a stir when it came out in March last year, which we think was caused by the book's name rather than its contents — it's unlikely that anyone could actually *learn* how to hack into a system just from reading about it. In the *Hacker's Handbook* the author, Hugo Cornwall, offers no magic formula to turn the reader into a super-cracker of account numbers and passwords. However, the hints he does give, such as 'Own names and those of loved ones are top favourites' and 'If the password is numeric, the obvious things to try are birthdays, home phone numbers, vehicle numbers . . . and so on', should be a salutory lesson to all who think such passwords are secure.

The book will give you a certain grounding in comms but, unfortunately, it does assume a basic familiarity with such things as RS232s and ASCII codes. However, if you are able to get past all that, there's a fair bit of useful information for the ordinary (law abiding) online computer user. The *Hacker's Handbook* is 168 pages, is very readable, and contains some interesting background information on a few of the more famous 'hacks'. The author sets out his own position clearly: he doesn't approve of hacking for profit, or destructive activities; the fun is all in finding your way into a system by your own wits — 'hacking is a recreational and educational sport,' he says. Also: 'Most hackers are not interested in perpetrating massive frauds, or modifying their personal banking, taxation and employment records,' he claims — nor, we suspect, would most hackers succeed if they were. Hacking is a lot more difficult than films such as *War Games* would have us believe.

The book has no index; there isn't even a detailed contents list — a major omission in our opinion, as neither of us is inclined to buy a non-fiction book unless it has a reasonable index.

The *Hackers Handbook* is published by Century.

Viatel news

The Canberra branch of the Australian Computer Society has started placing information about the branch's activities. For those living in the area, the material starts on page *440123#. Branch officials hope that the idea will spread to other parts of the ACS structure, and believe that their service could be expanded to cover all ACS activities.

A boycott of Viatel by domestic users was called for the week beginning May 26th (the day this column was written). Many subscribers are angry at the prospect of a 20% increase in time charges, and a 28% hike in the standing charge. Such increases are way over our 'banana republic' inflation rate, and may even result in a drop in revenue (judging by the number of messages we have seen from subscribers planning to drastically cut their usage). It certainly won't encourage those who have been considering the use of Viatel to sign on the dotted line.

System news

January and July are the months for our full system listings, so space is at a premium. The new entries are Ausnet, MacBBS, Griffith BBS, and AUSOM MacSIG. There are also a few minor changes to reflect newer information about operating hours, modem standards, etc.

We've heard of a new dial-up system in Melbourne for those who enjoy fantasy role-playing games. The system will support play-by-modem games, and should be on-line very soon.

What should we call the type of system this column is all about? "Bulletin Board" is too specific, and we never liked "Public Access Message System" as many aren't open to the public and messaging is only part of the story. Any suggestions?

This month's information providers were Philip Harding, Bob Fryer, Mike Purdy, Neil Barker, Ed Cox. We hastily scribbled a few notes that omitted our informants' names — to these people go our apologies and thanks.

Bludners

In "Viatel: One Year Later" (*APC* April 1986) the database of tenders was appropriated to the wrong organisation. Tendertex is operated by International Trade and Tenders Pty Ltd.

NSW

Ace BBS (02) 560 9846. 6pm-9am weekdays, 24 hours weekends.

Andromeda (02) 764 3598. 24 hours.

AUGABBS (02) 451 6575. MV. Mathew Barnes and Andrew Riley. 24 hours daily.

Augur TBBS (02) 661 4739. Mark James. 24 hours.

AUSBOARD (02) 95 5377. P. Daniel Moran. 24 hours daily.

Ausnet (02) 959 3712. 24 hours daily. V22, V22bis. For DEC users.

BERT (02) 211 0855. P. Resource Data. 24 hours daily. V23 videotex.

Bresike Omen (02) 457 8281. Geoff Arthur. 24 hours daily. TRS-80.

CCBBS BBS (02) 398 2413. 8pm-7am weekdays, 8am-5pm weekends.

CCUA BBS (02) 599 7342. 24 hours daily.

Club-80 RTRS (02) 332 2494. MV. Michael Cooper. 24 hours daily.

Commboard (02) 664 2334. MV Graham Lee. 24 hours daily. For Commodore 64 users, membership $25/year to 199 Coogee Bay Road, Coogee 2034.

Contact BBS (02) 550 1004. MV. Steven Williams. 9am-11pm weekdays, 24 hours weekends. Computer dating.

Csace BBS (02) 529 8249. 24 hours.

Dick Smith Electronics RIBM (02) 887 2276. P. Ian Lindquist. 24 hours daily. Program downloading.

Frontier Systems RIBM. (02) 875 2606. 24 hours.

Galaxy RAPL (02) 875 3943. 24 hours.

Infocentre. (02) 344 9511. M. 24 hours daily.

Irata BBS (02) 600 9041. 6pm-midnight weekdays, 24 hours weekends.

Keeboard (02) 629 2230. P. Philip Keegan. 24 hours daily.

MacBBS (02) 623 2287. P. Ed Cox. Nearly 24 hours daily. V21, V23.

MI Computer Club BBS. (02) 662 1686. MV Rose Vines. 24 hours daily. Program downloading.

MicroDesign Lab Citadel. (02) 663 0150 and (02) 663 0151. P. Stephen Jolly. 24 hours daily.

Nightline (02) 528 8968. P. Hamish Bowly. 10pm-7am daily. Mainly Apple.

Omen I (02) 498 2495. P. Ted Romer. 4.30pm-9am weekdays, 24 hours weekends. V21 and V23.

Palantir BBS (02) 451 6576. P. Steve Sharp. 24 hours daily.

Prophet RBBS (02) 628 7030. P. Larry Lewis. 24 hours daily.

Pursuit BBS (02) 522 9507. 24 hours.

RCOM BBS (02) 667 1930. MV. Simon Finch. 24 hours daily. For Commodore 64 users, software downloading to registered users only $20/year to Box 1542, GPO, Sydney 2001. Half duplex.

Renegade BBS (02) 631 2715. 9pm-7am daily.

RUNX Unix System (02) 487 2533. MV. Mark Webster. 24 hours daily. Call (02) 48 3831 for system status. Also on (02) 48 3831 (V22) and (02) 487 1860 (V23).

Scorpio BBS (02) 621 7487 MV. Russ Morrison. 24 hours daily. C64, full access $25 — contact 64 Blacktown Users Group.

Sentry BBS (02) 428 4687. 9pm-6am weekdays, 8pm-6am weekends.

Skull BBS (02) 529 8750. Les Ayling. 24 hours daily (but sometimes offline). Apple.

SMUG-BEE BBS (02) 607 7584. P. Bob Fryer. 24 hours daily. Microbee Software.

Sorcerer Users Group RCPM. (02) 387 4439. MV. John Woolner. 6pm-8am weekdays, 24 hours weekends. Ring-back system.

Sydney PC Users Group RIBM (02) 238 9034. 24 hours. Also (02) 221 5520 for V22. Bytenet listings.

Sydney Public Access RCPM (02) 808 3536. MV Barrie Hall and David Simpson. 24 hours daily.

Tandy RIBM (02) 625 8071. 24 hours daily.

Tesseract RCPM (02) 651 1404. MV. John Hastwell-Batten. 24 hours daily.

Texpac RBBS M. Shane Andersen. Mon & Tues 7pm-6.30am, Wed 7pm-Mon 6.30am. For membership write to TISHUG. (attn Texpac Sysop), PO Box 595, Marrickville, NSW 2204.

Tomorrowland's DIRECT (02) 411 2053. MV. Mike Kidson. 24 hours daily. Helpline: (02) 412 3909.

Zeta RTRS (02) 627 4177. Nick Andrew. 24 hours weekdays, 7pm-7am weekends.

Abcom RIBM (047) 36 4165. 24 hours.

Griffith Computer Association BBS P. (069) 62 7272. Greg Bodger. Ring-back System. Program dowloading.

Illawarra BBS (042) 84 4354.

Newcastle Microcomputer Club RCPM RBBS (049) 68 5385. MV. Tony Nicholson. 5pm-8.30am weekdays, 24 hours weekends. RBBS free to all, RCPM for members only — $4/year to PO Box 293, Hamilton, NSW 2303.

ACT

ACT Apple (062) 31 9462. Ian Warren. 10pm-6am daily.

Canberra IBBS (062) 58 1406. MV. 24 hours daily.

Canberra MICSIG RCPM (062) 85 1026. Ross Elliott. 24 hours daily.

Canberra RBBS (062) 88 8318. 24 hours daily.

Commodore User Group (ACT). (062) 54 7365. P. 24 hours daily.

DSA-80 RTRS (062) 41 4395. MV. Anonymous. 24 hours daily. Full access granted only to Canberra Micro 80 Users Group Inc and non-residents of Canberra.

PC Exchange (062) 58 406. 24 hours daily. V21, V22.

Victoria

AM-NET (03) 366 7055. Peter Hallgarten. 24 hours daily. V21, V23, and packet radio.

Atlantis International Computers RBBS (03) 277 6824. P. 24 hours daily.

AUSOM BBS (03) 877 1990. MV. Grahame Willis. 24 hours daily.

AUSOM MacSIG (03) 435 9152. P. 24 hours daily. For Macintosh users.

BERT (03) 602 1552. P. 24 hours daily. Business and economic news. Also on (03) 67 7371 for V23/Videotex users.

BUGM RCPM (03) 500 0562. P. Sol Green. Midnight-6pm Monday-Saturday, Midnight-Midday Sunday.

C64-BBS (03) 489 4557. MV. Alan Miles. 24 hours daily. Commodore 64 software up/downloading.

DECUS Melbourne Fido (03) 63 9133. Jay Ondracek. 24 hours daily. V21, V22, V23, V22bis. DECUS members only (but membership is free), caters for Rainbows to VAXes, public domain software downloading (CP/M and MS-DOS).

Down Under Software (03) 429 5819. Greg Hudson. 24 hours daily. V21, V22, V22bis and V23.

DUNCAN (03) 602 5200. P. 24 hours daily. Computer news and advertising.

Eastwood RCPM (03) 870 4623. Mick Stock. 4pm-midnight, Monday-Friday ONLY. V21 originate or answer due to poor line quality. Previously referred to as East Ringwood RCPM.

HiSoft IBBS Node 1 (03) 799 2001. Richard Tolhurst. 24 hours daily.

HiSoft IBBS Node 2 (03) 799 2041. Richard Tolhurst. 24 hours daily. V23 only.

Hi-Tech BBS (03) 397 1165. 24 hours.

Melbourne PIE (03) 878 6847. P. Len Gould. 24 hours daily.

MICOM CBMS (03) 762 5088. MV. Peter Jetson. 24 hours daily.

MicroBee RBBS. (03) 873 5734. G Forrest. 24 hours daily.

Millionaire — Off-line.

National (03) 819 5582. John Blackett-Smith. 24 hours daily. Now running Fido software, with international FidoNet links being arranged. ByteNet listings.

Omen IV (03) 846 4034. Philip Westh. 24 hours daily.

PC-Connection (03) 528 3750. MV. Lloyd Borrett. 24 hours daily. V21 and V22.

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SCUA RCPM/RBBS (03) 754 5081. MV. David Woodberry. 24 hours daily. Public domain software downloading for members of Sorcerer and CP/M Users of Australia, Inc.

Sunshine PC (03) 312 2259. Chris Whitefield. 24 hours daily.

The Real Connection (03) 288 0331. Carla Miller. 24 hours daily.

Viatel Computers (03) 288 3599. P. Max Elliot. 24 hours daily. V21, V22, V23.

Victorian Apple Bulletin Board (03) 877 1990. Graham Willis. 24 hours daily.

Mail-Bus (051) 27 7245. M. Max Moore. 24 hours. Membership virtually essential. Write to PO Box 234, Newborough, Vic 3825.

MIN-NET (054) 41 3013. MV. Mal Fields. 24 hours daily. Enquiries to (054) 43 2589 during business hours ONLY.

Queensland

ACEA. (07) 341 0285 24 hours daily. Commodore.

AM-PAK RCPM (07) 263 7070. John Bews. 24 hours weekdays (V21), 24 hours weekends (V22, V22bis, Bell 103).

BEX II RCPM (07) 395 1809. Rick Dalley. 24 hours daily.

Brisbane Microbee RCPM (07) 384 8333. John Wain. 24 hours daily.

Brisbane Experimental RCPM (07) 395 1809. Rik Dalley. 24 hours daily.

CCUG (07) 808 2125. 24 hours daily. Commodore users' group.

Competron IBBS (07) 52 9498. 24 hours daily.

Computer Orchard (07) 350 1300. Scott Pearse. 24 hours daily. Software downloading (Apple II, Mac, IBM PC).

ED-RCPM (07) 266 3369. Andrew Waddell. 24 hours daily. Emphasis on education, software downloading for many systems.

HiTech CBBS (07) 38 6872. 24 hours daily.

Hotline (07) 353 3718. Lionel Theunissen. 24 hours daily.

Kangaroo Point TAFE (07) 391 3788. Troy O'Malley. 9am-10pm weekdays, 24 hours weekends.

Midnight Express (07) 856 4363. Lloyd Ernst. 24 hours daily.

TI-BBS (07) 263 6161. 7pm-6am weekdays only.

Tomorrowland (07) 394 2300. 24 hours daily.

CAD-IBBS (070) 51 1360. Neil Barker. 24 hours daily. V21, V22, V23. Software for IBM, Microbee, Amstrad, Commodore etc.

CoCoLink (075) 32 6370. 24 hours daily. For Tandy Color Computer users.

SA

Adelaide Micro Users Group BBS (08) 271 2043. MV. 9am-9pm weekdays, 10am-10pm weekends and public holidays.

Computer Ventures CBBS (08) 255 9146. Daniel Schumacher. 24 hours daily.

The Electronic Oracle (08) 260 6686. MV. Don Crago and Grayham Smith. 24 hours daily. V21, V22, V23, V22bis.

Multiple BBS (08) 255 5116. 24 hours daily.

Nexus (08) 243 2477. 24 hours daily.

Omen V (08) 382 4631. 6pm-7am daily.

SAC64 (08) 382 4631. 24 hours daily. Commodore users' group.

NT

Omen II (089) 27 4454. Terry O'Brien. 24 hours daily.

Outback RCPM (089) 27 7111. Phil Sampson. 24 hours daily.

Red Centre RCPM (089) 52 8852. 24 hours daily.

WA

Applecross (09) 364 9924. 24 hours.

Atarians (09) 409 7251. 24 hours daily.

Computext (09) 447 0522. Russell Stokes. 24 hours daily.

MiniPro C64 (09) 337 3400. 24 hours, Mon-Fri only.

Mouse Exchange (09) 330 5530 8.30pm-7.30am daily.

NEMO (09) 370 1855. Graeme Platt. 24 hours daily.

Omen III (09) 279 8555 Greg Watkins. 24 hours daily.

Omen Mini (09) 279 8555. 24 hours.

The PAD (09) 337 2941. 24 hours daily. V21 and V23.

Trash II (09) 478 1163. 8pm-7am daily. Commodore 64.

Kalgoorlie College RCPM (090) 21 7755. P. 24 hours daily.

Tasmania

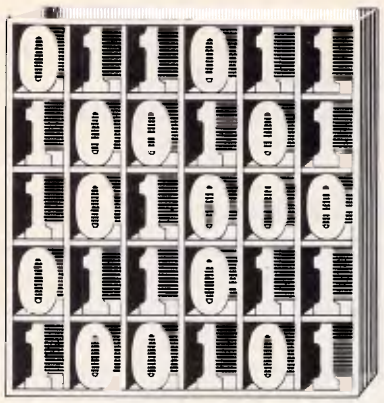
Computercraft IBBS (003) 31 8466. Andre Everts. 24 hours daily.

Launceston BBS (003) 34 0911. 24 hours.

Ian Campbell TBBS (003) 26 4248. 24 hours.

The material in this column is presented in good faith, but as it is collated from information provided by readers, *APC* cannot take responsibility for its accuracy. New information and corrections are always welcome (but please mention whether or not you can vouch for its accuracy), and should be sent to Steve Withers at one of the following addresses: C/- Computer Publications, 77 Glenhuntly Road, Elwood, Victoria 3184. Viatel 063000030, ACSnet stephenw@murdu, Teledata 11UNRWITHERS. Acknowledgement will generally be made through this column.

END



David Barrow presents more documented machine code routines and useful information for the assembly language programmer. If you have a good routine, an improvement or conversion of one already printed, or just a helpful programming hint, then send it in and share it with other programmers. Subroutines for any of the popular processors and computers are welcome but please include full documentation. All published code will be paid for. Send your contributions to Subset, APC, 2nd Floor, 215 Clarence Street, Sydney 2000.

68000 SERIES CONDITION CODES ACCESS

In November 1985 I explained how access to the Condition Codes Register in User Mode required a different instruction for the 68000 and 68008 side of the family (MOVE SR, <EA>) to that of the 68010 and 68020 virtual machines (MOVE CCR, <EA>).

So far, only Terry Browning has attempted to provide a useful, truly portable routine to put the CCR on top of stack — ready for use within a subroutine or for RTR exit. Terry describes the result PSHCCR (Datasheet 1) as 'a mess, taking about 200 cycles to execute.'

Without denigrating Terry's programming skill, I have to agree that, despite a hint of elegance, PSHCCR is undoubtedly a costly way to read the 68000's flags.

Nevertheless, the only alternative to this or a similar routine is to rely entirely on the system software's ability to trap an illegal instruction or privilege violation and return the CCR state from the exception. This, too, is likely to be quite slow because of the lengthy internal interrupt processing. Furthermore, exceptions are bound to introduce timing uncertainties when precise timing could be crucial.

```
PSHCCR MOVEM.W D0-D1,-(A7)      :Use D1 to make 2-byte          48A7
                                :workspace and save D0 on       C000
                                :top of stack.
       SF      D0               :Initially clear all flag       51C0
                                :bits in D0.B, using "SF"
                                :since "CLR" affects CCR.
;
:..."BSET" affects Z flag, so begin synthesis with Z. Build CCR
:...copy in D0 left shifted 4 bits for later rotate to get X.
PCCRZ  BNE     PCCRN            :Okay if Z reset, else set      6604
       BSET    #6,D0            :corresponding D0 bitno. +4.    08C0
                                :                               0006
PCCRN  BPL     PCCRV            :Okay if N reset, else set      6A04
       BSET    #7,D0            :corresponding D0 bitno. +4.    08C0
                                :                               0007
PCCRV  BVC     PCCRC            :Okay if V reset, else set      6804
       BSET    #5,D0            :corresponding D0 bitno. +4.    08C0
                                :                               0005
PCCRC  BCC     PCCRX            :Okay if C reset, else set      6404
       BSET    #4,D0            :corresponding D0 bitno. +4.    08C0
                                :                               0004
PCCRX  ROXR.B  #4,D0            :Rotate X into D0, shifting     E810
                                :"flags" to correct places.
       AND1.W  #$00FF,D0        :Clear D0(15-8) for zero        0240
                                :system byte on stack.          00FF
       MOVE.W  4(A7),2(A7)      :Move stacked return address    3F6F
                                :up stack (down memory) by      0004
                                :2 bytes to make room for       0002
       MOVE.W  6(A7),4(A7)      :copied CCR to go on return     3F6F
                                :stack top. Use word ops to     0006
                                :ensure no overwriting.         0004
       MOVE.W  D0,6(A7)         :Put copied CCR to return       3F40
                                :stack top (below ret addr).    0006
       MOVE.W  (A7)+,D0         :Restore D0.                    301F
       MOVE    4(A7),CCR        :Restore CCR from stack copy    44EF
                                :(system byte not affected).    0004
       RTS                      :Exit with CCR on stack top.    4E75
```

DATASHEET 1

```
:-------------------------------------------------------------------
:= PSHCCR       68000-series MOVE from CCR to User Stack.
:-------------------------------------------------------------------
:JOB            68000-series fully portable push of CCR to User
:               Stack (A7) without using "MOVE CCR,-(A7)" (not
:               available on 68000 or 68008) or "MOVE SR,-(A7)"
:               (not available on 68010 or 68020).
:ACTION         Clear CCR copy register, D0.
:               FOR each condition code: ZNVC
:               [ IF condition set
:                 [ Set copy bit in D0, 4 bits higher. ] ]
:               Rotate copy register right through eXtend 4 bits
:               shifting all copy flags to correct bit position.
:               Stack CCR copy register below return address.
:-------------------------------------------------------------------
:CPU            68000-series.
:HARDWARE       None.
:SOFTWARE       None.
:-------------------------------------------------------------------
:INPUT          None.
:OUTPUT         Copy of CCR on User Stack top (A7).
:               (Stacked SR system byte = 0.)
:               No other registers or flags affected.
:ERRORS         None.
:REG USE        None.
:STACK USE      (User Stack, A7): 4.
:               (PSHCCR increases program stack use by 2.)
:RAM USE        None.
:LENGTH         60
:CYCLES         68000: 178 + 10 for each set N,Z,V,C flag.
:               68008: 332 + 14 for each set N,Z,V,C flag.
:               68010: 178 + 10 for each set N,Z,V,C flag.
:               68020: 135 + 1 for each set N,Z,V,C flag (max).
:-------------------------------------------------------------------
:CLASS 1     *discreet       *interruptable      *promable
:******      *reentrant      *relocatable        *robust
:-------------------------------------------------------------------
```

QUICKER Z80 SOUNDEX

SOUNDX (Datasheet 2) from James Day is a far speedier version of John Hardman's routine (September 1985). Although timing will vary considerably depending on the string being processed, James estimates that his routine will execute on average some five times faster than the original SOUNDX. It is also five bytes shorter and uses two bytes less stack space.

Much of the speed increase is as a result of random table access rather than the sequential read used by John's routine. The letter to be encoded is added as offset to the table base address and the corresponding code value (0 to 6) read of.

One very useful trick used by James is not to follow the convention of converting the letters' ASCII values to simple offsets in the range 0 to 25 but instead to form a displaced base address to the table such that the lowest valid offset will index the first value in the table.

Another trick, which shortens the table by one byte and gains a slight increase in speed, is to disregard 'A' when testing for validity since a null code would be returned anyway.

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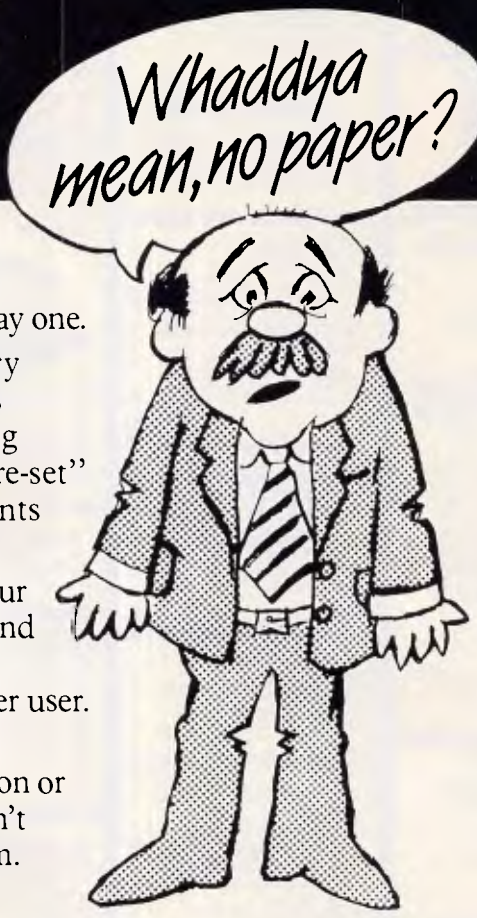

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DATASHEET 2

```
;
;= SOUNDX    Letter sequence to 4 character SOUNDEX code.
;
;JOB         To encode a letter sequence as a single upper case
;            letter followed by 3 decimal digits such that
;            phonetically similar sequences produce identical
;            codes.
;ACTION      Read 1st (upper-case) source character.
;            IF character is letter (A to Z)
;            [ Write letter to result.
;              WHILE result < 4 bytes AND digit > NULL.
;              [ Save last digit (or 1st letter).
;                Read (upper-case) source character.
;                Convert to Soundex code digit.
;                IF digit <> last digit
;                [ Write digit to result. ] ] ]
;            IF result < 4 bytes
;            [ Pad result with '0's. ]
;
;CPU         Z80
;HARDWARE    Source memory. Destination RAM.
;SOFTWARE    None.
;
;INPUT       DE addresses 1st byte of source string.
;              Source string should terminate with a null byte.
;            HL addresses 1st byte of 4-byte SOUNDEX destination.
;OUTPUT      All registers and flags unchanged.
;            Destination contains 4-byte SOUNDEX code of source.
;ERRORS      None.


;REG USE     DE HL
;STACK USE   10
;RAM USE     None.
;LENGTH      95 (code: 70, appended table: 25).
;CYCLES      Depends on source contents.
;
;CLASS 2      *discreet       *interruptable      *promable
;****-*       *reentrant      -relocatable        *robust
;
;
SOUNDX PUSH AF          ;Save registers and flags          F5
       PUSH DE          ;used in SOUNDX.                   D5
       PUSH HL          ;                                  E5
       PUSH BC          ;                                  C5
       LD   B,4         ;Count for 4 SOUNDEX characters.   06 04
       LD   A,(DE)      ;Get 1st source character,         1A
       AND  0DFH        ;ensure upper case,                E6 DF
       CP   'A'         ;and test for letter (A to Z)      FE 41
       JR   C,PADEND    ;skipping to pad out with          38 2F
       CP   'Z'+1       ;'0's if not letter.               FE 5B
       JR   NC,PADEND   ;                                  30 2B
       JR   STORE       ;Else save initial letter          18 22
;
SAVDLD LD   C,A         ;Save copy of last char/code.      4F
;
NEXTCH INC  DE          ;Address next source character     13
       LD   A,(DE)      ;and get it.                       1A
       AND  A           ;Test for source string end        A7
       JR   Z,PADEND    ;skipping to '0' pad if so.        28 23
       AND  0DFH        ;Ensure upper case and test        E6 DF
       CP   'B'         ;for within table range (B to Z)   FE 42
       JR   C,NEXTCH    ;looping to get next character     38 F5
       CP   'Z'+1       ;if non-letter or 'A' (vowels      FE 5B
       JR   NC,NEXTCH   ;have no SOUNDEX code).            30 F1
       PUSH HL          ;Save destination pointer and      E5
       LD   HL,SNDTAB-'B' ;use HL to address table at      21 lo hi
       ADD  A,L         ;offset allowing for ASCII codes.  85
       LD   L,A         ;Add source upper-case letter      6F
       LD   A,0         ;code to index corresponding       3E 00
       ADC  A,H         ;SOUNDEX code in HL.               8C
       LD   H,A         ;                                  67
       LD   A,(HL)      ;Get SOUNDEX code and              7E
       POP  HL          ;restore destination pointer.      E1
       AND  A           ;Test for null code and go get     A7
       JR   Z,NEXTCH    ;next source char if so.           28 E2
       CP   C           ;Test for repeat of last code      B9
       JR   Z,NEXTCH    ;and get next char if so.          28 DF
;
STORE  LD   (HL),A      ;Write char/code to destination    77
       INC  HL          ;and index next dest. byte.        23
       DJNZ SAVDLD      ;Repeat for 4 SOUNDEX bytes.       10 DA
       JP   SXEXIT      ;Go exit.                          C3 lo hi


;
PADEND LD   (HL),'0'    ;Write '0' to destination and      36 30
       INC  HL          ;index next destination byte.      23
       DJNZ PADEND      ;Repeat for 4 SOUNDEX bytes.       10 FB
;
SXEXIT POP  BC          ;Restore registers and flags       C1
       POP  HL          ;used in SOUNDX and exit           E1
       POP  DE          ;with pointers unchanged.          D1
       POP  AF          ;                                  F1
       RET              ;                                  C9


;
SNDTAB DEFB '123'       ;          BCD             31 32 33
       DEFB 0,'12'      ;          EFG             00 31 32
       DEFB 0,0,'2'     ;          HIJ             00 00 32
       DEFB '245'       ;          KLM             32 34 35
       DEFB '5',0,'1'   ;          NOP             35 00 31
       DEFB 0,'62'      ;          QRS             00 36 32
       DEFB '3',0,'1'   ;          TUV             33 00 31
       DEFB 0,'2',0     ;          WXY             00 32 00
       DEFB '2'         ;          Z               32
```

8086 SOUNDEX

NAMEX (Datasheet 3), from Finbarr Murphy, is a SOUNDEX routine for the 8086. Finbarr wrote it after reading an article by Bob Chappel in *Microcomputer Printout* (August 1982) and says that he has used it successfully with dBaseII on his IBM PC. As written, the routine can cope only with strings up to 11 letters in length, assumed to be surnames. These must be preloaded into the routine's workspace terminated with a carriage return character.

One aspect of SOUNDEX coding missed by all of John Hardman, James Day and myself is that (rarely) the initial letter may be repeated, as in the names FFOULKES and LLOYD. Both SOUNDX routines will erroneously include the code for the repeated occurrence after the letter — for example, LLOYD will be encoded as L430 when it should be L300. Finbarr's NAMEX guards against this happening by always encoding the initial letter as the first SOUNDEX byte, so allowing repetition testing on it, and replaces it by the actual letter only after the full code has been found.

NAMEX makes fairly good use of the 8086 string processing instructions, both as simple primitives and with the REPeat prefixes for iterative processing. The sequential table search is performed by the combined instruction 'REPNE SCASB' which utilises the auto-incrementing address in register DI and alphabet length count in CX. The corresponding code is then read from the location 25 bytes greater than the value in DI after a match is found.

Were BX not being used as count register, a far quicker method of table lookup, making better use of the 8086 instructions is suggested by James Day's SOUNDX. After validating the character in AL as a letter, load BX with a value 41 less than the address of the codes table (so the offset 'A' indexes the first entry) and use 'XLAT' to read into AL the value contained in location [BX+AL]. END

DATASHEET 3

```
;
;= NAMEX     11-letter name to 4 character SOUNDEX code.
;
;JOB         To encode a sequence of up to eleven letters as
;            a single upper case letter followed by 3 decimal
;            digits such that phonetically similar sequences
;            produce identical codes.
;ACTION      Set result to default '00000'.
;            Read 1st (upper-case) character.
;            IF character is letter
;            [ Write character to firstchar store.
;              WHILE character NOT terminator AND count <=4
;              [ Read (upper-case) character.
;                IF character is letter
;                [ Convert to SOUNDEX code.
;                  IF code NOT '0'
;                  [ IF count=0 OR code<>lastcode
;                    [ Write code to result.
;                      Increment count. ] ] ] ]
;              Move firstchar to result. ]
;
;CPU         8086/8088
;HARDWARE    Possible storage and table use of memory if not
;            appended to program.
;SOFTWARE    None.
;
;INPUT       Name of 1 to 11 letters, terminated by carriage-
;            return (0DH), must be in NAME storage.
;OUTPUT      SOUNDEX code in CODE storage terminated by '$'.
;            ('0000$' output for invalid name).
;ERRORS      None if input conditions observed.
;REG USE     F
;STACK USE   10
;RAM USE     Input and output storage and conversion table is
;            directly addressed.
;LENGTH      169 (code : 99, table: 52, storage: 18).
;CYCLES      Not given.
;
;CLASS 2     -discreet       *interruptable      -promable
;-*---*      -reentrant      -relocatable        *robust
;
```

SUBSET

```
;
NAMEX   PUSH   AX              ;Save registers used        50
        PUSH   BX              ;in NAMEX.                  53
        PUSH   CX              ;                           51
        PUSH   DI              ;                           57
        PUSH   SI              ;                           56
        CLD                    ;Clear for auto-increment.  FC
        XOR    BX,BX           ;Clear result counter.      33 DB
        LEA    DI,[FCHAR]      ;Address result storage,    8D 3E lo hi
        MOV    CX,5            ;count for 5 bytes,         B8 05 00
        MOV    AL,'0'          ;using AL='0', initialise   B0 30
        REP                    ;result store to            F2
        STOSB                  ;to '00000'.                AA
        LEA    SI,[NAME]       ;Address input source name  8D 36 lo hi
        LODSB                  ;and get 1st character,     AC
        AND    AL,0DFH         ;ensuring upper-case.       24 DF
        CMP    AL,'A'          ;Test for character is      3C 41
        JL     ERROR           ;letter (A to Z) and        7C 3F
        CMP    AL,'Z'          ;skip out in error          3C 5A
        JG     ERROR           ;if not.                    7F 3B
        MOV    [FCHAR],AL      ;Save 1st character and     A2 lo hi
        JMP    FIRST           ;go get its SOUNDEX code.   EB 07
;
AGAIN   LODSB                  ;Get next character and     AC
        CMP    AL,0DH          ;test for <CR> terminator,  3C 0D
        JZ     EXIT            ;ending if so, else         74 2B
        AND    AL,0DFH         ;ensure upper-case.         24 DF
;
FIRST   MOV    CX,26           ;Set table letter count,    B9 1A 00
        LEA    DI,[LTAB]       ;address letter table       8D 3E lo hi
        REPNE                  ;and search until match     F2
        SCASB                  ;of character or CX=0       56
        JCXZ   AGAIN           ;in which case, get next.   E3 EE
        MOV    AL,[DI+25]      ;Get corresponding code     8A 45 19
        CMP    AL,'0'          ;and test for '0', go       3C 30
        JNZ    EXCEPT          ;write code if not, else    75 06
        CMP    BX,0            ;if not 1st character       81 FB 00 00
        JG     AGAIN           ;go get next one.           7F E1
;
EXCEPT  LEA    DI,[BX+CODE]    ;Address current result     8D BF lo hi
        CMP    AL,[DI-1]       ;byte and if repeat, go     3A 45 FF
        JZ     AGAIN           ;get next character.        74 DB
        STOSB                  ;Else write code digit      AA
        INC    BX              ;and point to next.         43
        CMP    BX,4            ;If not end then go         81 FB 04 00
        JL     AGAIN           ;process next character.    7C D0
;
EXIT    MOV    AL,[FCHAR]      ;Finally, transfer 1st      A0 lo hi
        MOV    [CODE],AL       ;letter to SOUNDEX code.    A2 lo hi
;
ERROR   POP    SI              ;Restore registers          5E
        POP    DI              ;used in NAMEX.             5F
        POP    CX              ;                           59
        POP    BX              ;                           5B
        POP    AX              ;                           58
        RETF                   ;Long return.               CB
;
FCHAR   DB     0               ;1st letter storage.        00
CODE    DB     4 DUP(0),'$'    ;SOUNDEX code result        00 00 00 00
                               ;storage.                   24
NAME    DB     12 DUP(13)      ;Input name space.          0D 0D 0D 0D
                               ;It must terminate with     0D 0D 0D 0D
                               ;carriage-return.           0D 0D 0D 0D
LTAB    DB     'ABCD'          ;Letter to SOUNDEX code     41 42 43 44
        DB     'EFGH'          ;conversion table.          45 46 47 48
        DB     'IJKL'          ;                           49 4A 4B 4C
        DB     'MNOP'          ;                           4D 4E 4F 50
        DB     'QRST'          ;                           51 52 53 54
        DB     'UVWX'          ;                           55 56 57 58
        DB     'YZ'            ;                           59 5A
        DB     '0123'          ;SOUNDEX code digits        30 31 32 33
        DB     '0120'          ;in alphabetic order.       30 31 32 30
        DB     '0224'          ;                           30 32 32 34
        DB     '5501'          ;                           35 35 30 31
        DB     '0623'          ;                           30 36 32 33
        DB     '0102'          ;                           30 31 30 32
        DB     '02'            ;                           30 32
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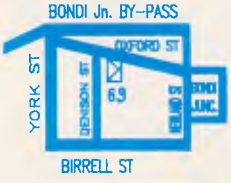

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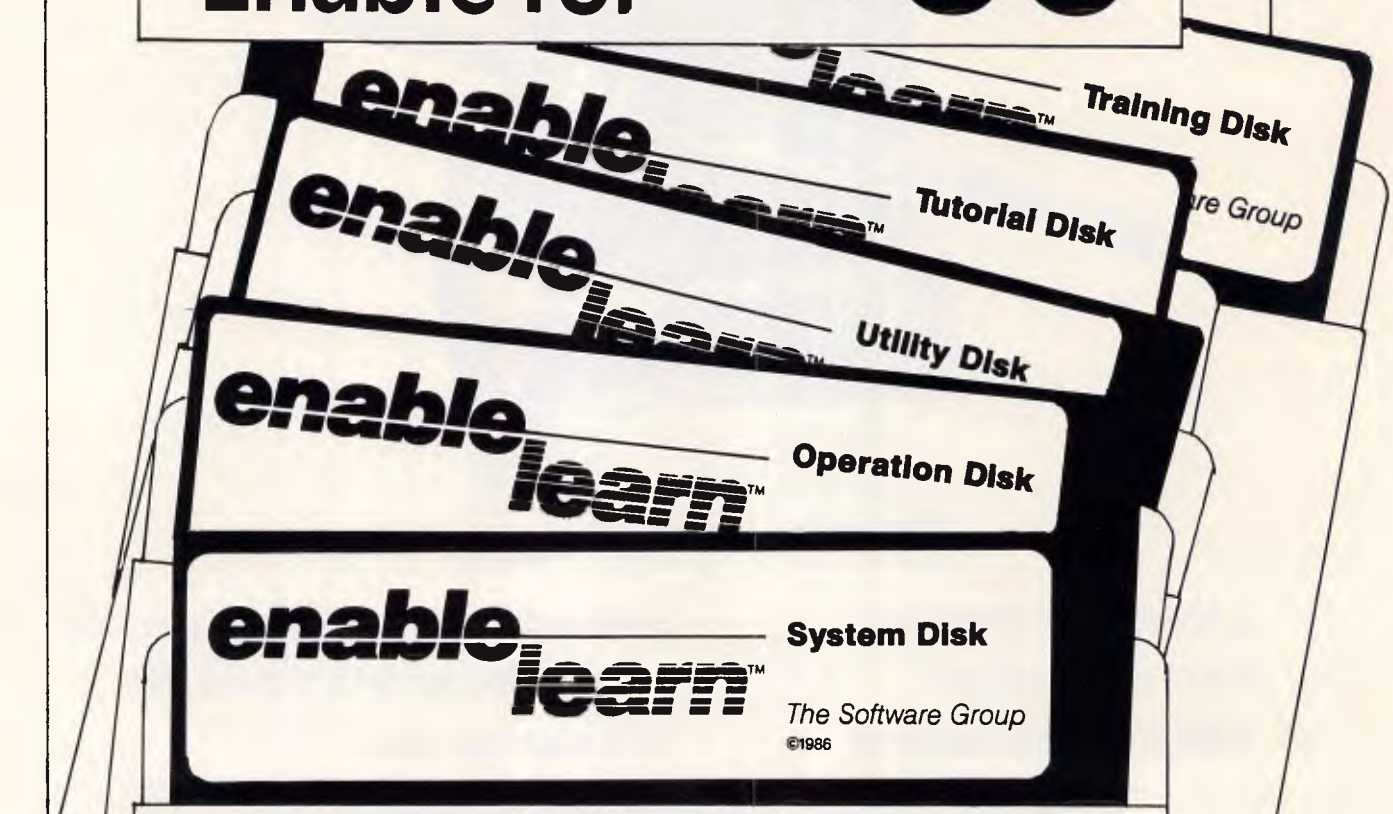

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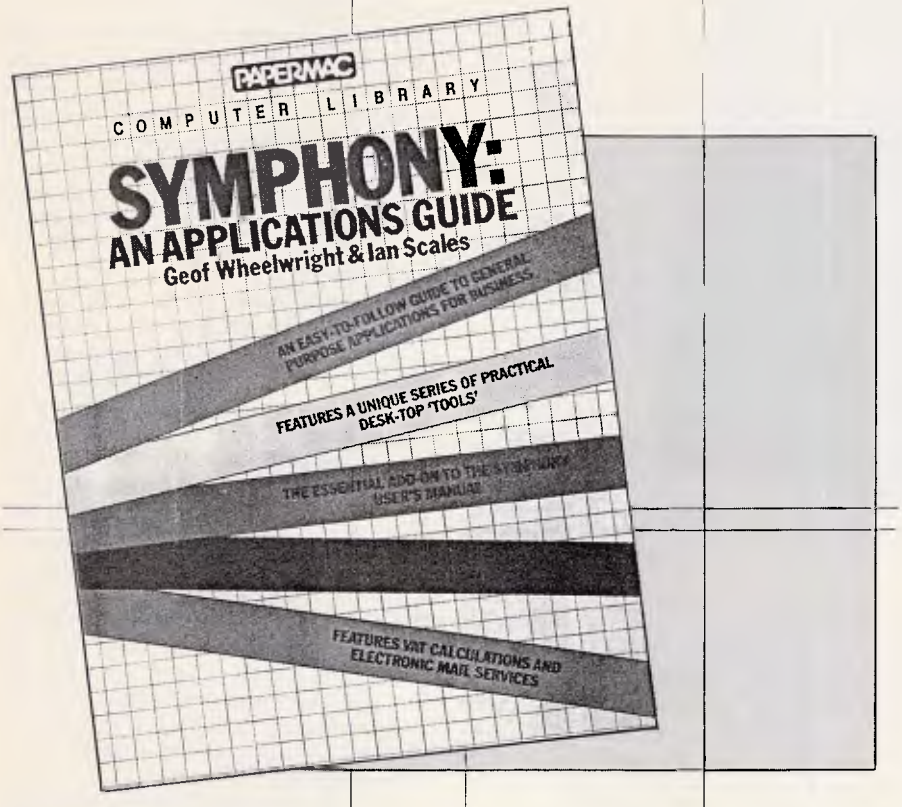
BIBLIOFILE

If you're in the mood for cybernetic music or a look at Sir Clive Sinclair's life history, this month's book review is for you. David Taylor is your host.



Musical chores

Symphony is a kind of Lotus 1-2-3 with knobs on — a monster spreadsheet with such integrated goodies as a straightforward word processing, hard-to-grasp database service, limited business graphics and a communications set-up. Packages like this (and such big rivals as Framework and Open Access) have lately enjoyed fashionable success as all-in-one solutions to the bore of switching between popular applications, and fans like the authors here can soon become bemused by their power and versatility (the program's that is).

Yet these two want more — such as a desk-top calculator or a pop-up diary, and suggest that instead of pre-loading the likes of Spotlight or Sidekick, you set up Symphonic macros. Then they seek to encourage you to stir Symphony's 'sleeping giant' comms to access Viatel, they devise a neat ledger to compare your bank's statements with your cheque stubs, and they hold hands through a series of off-the-shelf Symphony tutorials.

It's all right as far as it goes, but it isn't all that far and I'd hesitate to endorse the authors' claim that here is 'an essential add-on to the *Symphony User's Manual.* That, you may have discovered, is a small plastic suitcase of instruction which is quite enough to digest. If Symphony is at all times music to your ears, then I dare say you'll enjoy fiddling about with this book's DIY modules. If not, I shouldn't worry.

Title: Symphony: An Applications Guide
Authors: Geof Wheelwright
and Ian Scales
Publisher: Papermac/Macmillan
Price: $29.95

Art'll fix it

Art says you need to have mastery over your machine. It's not enough, Art says, to run your software, maybe program some; you gotta understand what's cooking in there.

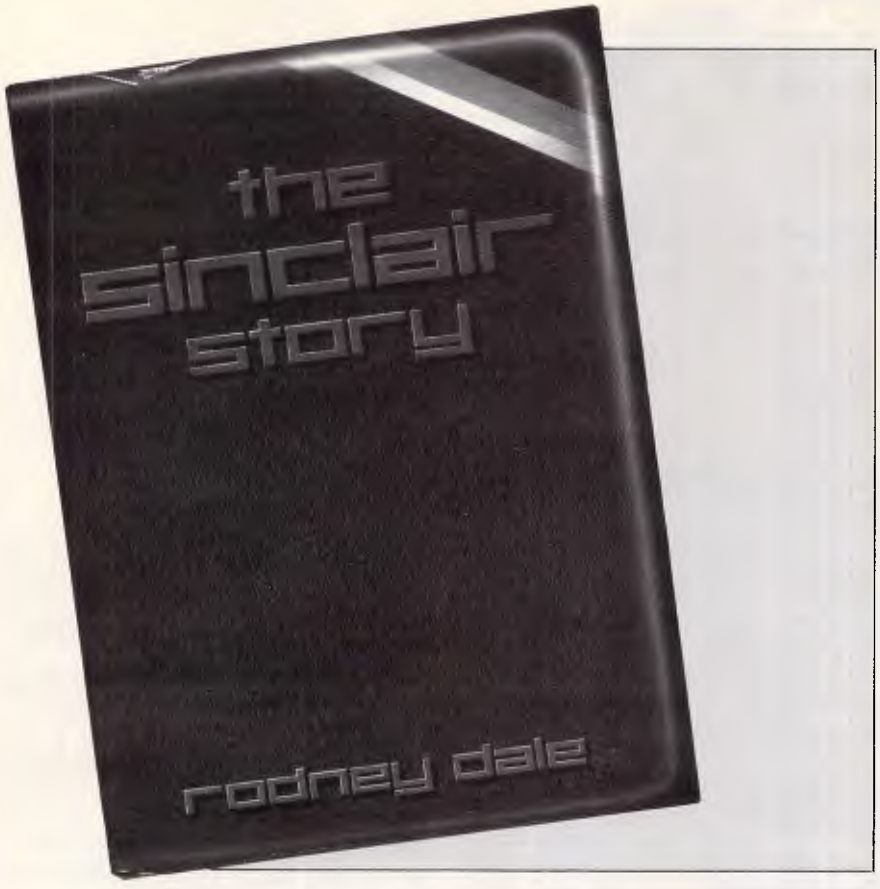
It isn't any kind of manual or analogue machine you have with a micro. It's a digital electronic entity. To figure it, you should learn electronics from the bottom up. That way you'll appreciate what the machine does much better, so you'll use it better. And if it malfunctions, why — maybe you can fix it. Art, by the way, is himself a service technician.

Well. If you can take the gee-whiz presentation, this is a lively and fast-moving introduction to computer electronics. You get a pretty detailed picture of how the MPU chats up the RAM, ROM and I/O chips, get to know analogue from digital and how interface circuits perform the switch. In no time the motherboard seems like one of the family. Art's a good teacher.

But. I'd hesitate to endorse Art's gung-ho approach to trouble-shooting faults. He makes it all sound a cinch, but computers aren't only delicate, they're potentially deadly besides. Remember: all of Art's mains voltages are the US's 120 volts. Make a single mistake with Australian's 240 volts and the chances are that will be that.

I'm all for absorbing the theoretical know-how of the digital world, but extremely cautious of hands-on tinkering until you know precisely what you're at. Art's book, good as it is, is not enough. If you're determined to lay spanners on any micro's innards, first get thoroughly trained.

Title: Computer User's Guide To Electronics
Author: Art Margolis
Publisher: Tab (Thomas Nelson Aust.)
Price: $30.90



Clive who?

I dare say that the PC fraternity roughly divides between those who think the sun shines out of Sinclair, and those who dismiss him as a pain in the operating system. Either way, there's no doubt that charismatic Sir Clive can claim an extraordinary string of legendary successes, nor that he has suffered some equally spectacular failures.

Mr Dale's attempt is a let-down. What he does, more or less *all* that he does, is plod past the well-known milestones of Sir Clive's career, from the first stirrings of scribbling radio circuits in his school exercise books and contributing to *Practical Wireless*, up until The Great C5 Farce and very recent Maxwellian manoeuvres, by way of Sinclair Radionics and the mighty Micro-6, the hi-fi boom, the world's first pocket calculators, the long struggle to perfect a pocket,TV the bedevilled Black Watch, the NEB saga, and of course his cheap and cheerful home computers from the ZX-80 to the QL.

All interesting stuff, as far as it goes. Trouble is, it only goes as far as setting out the bare facts of Sinclair's commercial history. We get no clues as to what makes the maestro tick, no revealing insight into his character or temperament, few hints of the extraordinary force of his personality which superficially seems so shy, yet which has such relentless determination, a breathtaking gift for self-promotion, plus a quality of almost mystical wonder when Sir Clive chooses to indulge his popular public image as the bearded, bespectacled, brain-storming boffin.

Mr Dale claims to have known Sinclair for over 20 years, and yet from this account seems scarcely to know him at all. He's clearly kept meticulous tabs on what Sinclair produced when, but seems loath ever to criticise objectively, or even to stop and analyse what prompted or sustained the flood of Sir Clive's invention and his policy of bash-on regardless — sometimes inspired, at other times apparently reckless. One day I'd imagine a gripping book could be written around the Sinclair phenomenon. Regrettably, this isn't it.

Title: The Sinclair Story
Author: Rodney Dale
Publisher: Duckworth/Cambridge University Press
Price: $30.00

With a one and a two . . .

As a Buddy Holly and/or Mozart man myself, I'm not about to argue with this:

'STRUC and associated globals. At S-time for the next two harmonizations (I=1 and I=2), the function keeps only those chords in the array of harmonic alternatives whose structure indices (row numbers in SIGMA) are in the right argument. By establishing global variables such as MA, MI and M17 to be used for that argument, the user needn't remember how to associate particular chords with row indices, i.e., MA can contain the proper index for THE major structure, MI for the minor, and M17 for the minor seventh.'

As Jaxitron himself is quick to acknowledge, the concept of cybernetic music is heady stuff, and 'contrapuntal mixing of tradition and unorthodoxy introduces overtones that will not reverberate satisfactorily for all readers at all times.' Too right, Jaxitron. The brief here is to use the principles of AI modelling and expert systems to help compose original music or perform such time-consuming tasks as transposing or orchestrating.

As you might guess, the music is not of the *tum-ti-tum* kind, but of the avant-garde kind which, to the untutored ear, tends to sound like what you'd hear were you to sit with your ear pressed to the side of your Hotpoint Jaxitron twin-tub on a boil wash, while friends whacked the other side with bin lids.

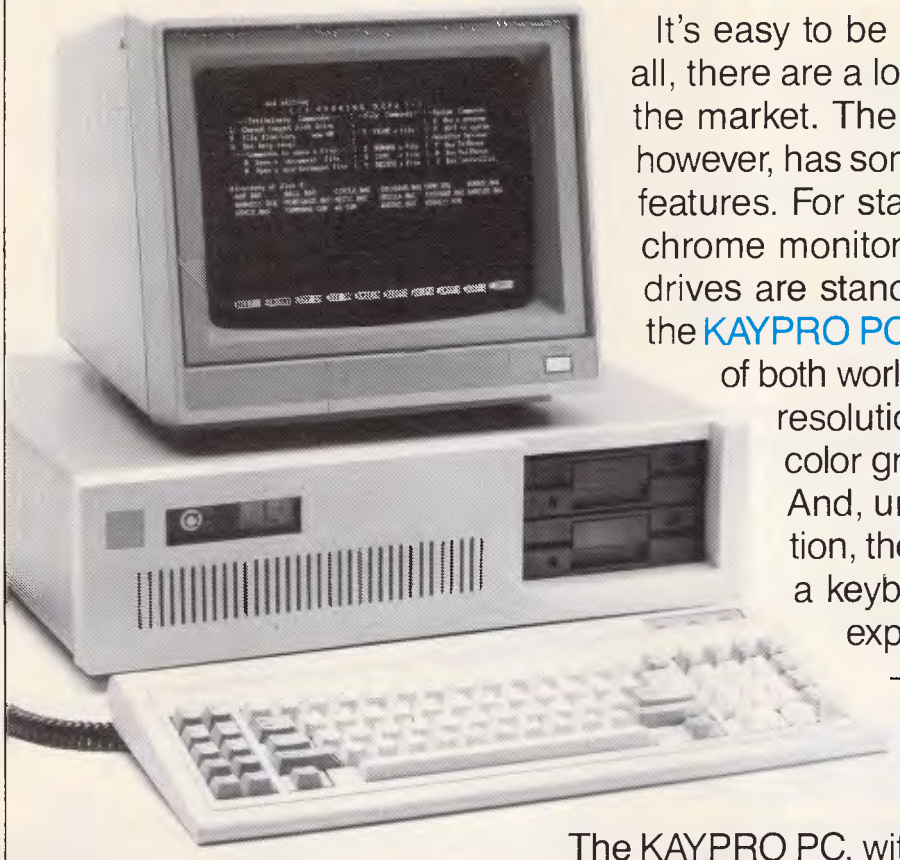
If you warm to the notion that rhythmic, harmonic and melodic elements in music — or even musical idiom, style or form — can be usefully set down as complex mathematical vectors, arrays and matrices; and if, moreover, you are at home with the APL programming language, you will no doubt find this a fascinating work.

If not, on the other hand, you won't.

Title: Cybernetic Music
Author: 'Jaxitron'
Publisher: Tab (Thomas Nelson Aust.)
Price: $36.90

END

Don't Be Fooled By Expensive Imitations



It's easy to be confused. After all, there are a lot of *beige* PCs on the market. The KAYPRO PC, however, has some very distinctive features. For starters, a monochrome monitor and *two* disk drives are standard. In addition, the KAYPRO PC boasts the best of both worlds – perfect high-resolution text and built-in color graphics capability. And, unlike the competition, the KAYPRO PC has a keyboard just like the expensive IBM PC AT – security lock and all.

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END ZONE

BENCHMARKS

A list of Benchmarks used when evaluating micros is given below. An explanation can be found in the February '84 issue.

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END

100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END

100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END

100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN

100 REM Benchmark 6
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GUSUB220
170 FORL=1 TO 5
180 NEXTL
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN

100 REM Benchmark7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190 NEXTL
200 IF K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN

100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K  2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

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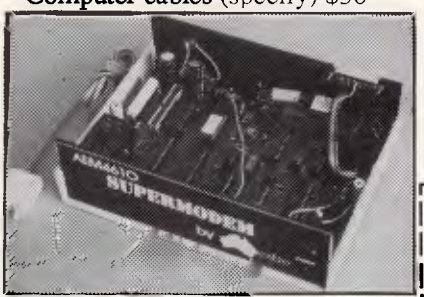

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Sydney	Videotex '86 Contact: Riddell Exhibition Promotions (03) 429 6088	July 1-3, 1986
Sydney	Ausgraph '86 Contact: Robyn Hughes (02) 266 9711	July 7-11, 1986
Sydney	New Product and Technology Expo Contact: Park Productions (02) 439 7738	July 17-21, 1986
Gold Coast	ACC '86 Contact: Riddell Exhibition Promotions (03) 429 6088	September 16-20, 1986
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Printers supported on the Apple version:
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Printers supported on the Atari version:
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Printers supported on the Commodore version:
C. Itoh Prowriter 8510 and Prowriter Jr.; Commodore VIC-1525 and MPS-801/803; EPSON FX, RX, and MX with Graftrax; Okideta 92, 93, 192 and Okimete 10; Star Gemini 10 end 15.

Printers supported on the CP/M version:
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Comparison Chart

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Apple II/IIe/IIe	Art Gallery I	$45.00
Commodore 64/128	Print Master	$49.95
Commodore 64/128	Art Gallery I	$39.95
CP/M	Print Master	$49.95
CP/M	Art Gallery	$39.95
Atari-ST	Print Master	$49.95
Atari-ST	Art Gallery	$39.95

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NUMBERS COUNT

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Definitions (i) A *prime number* is a positive integer which is only exactly divisible by itself and unity (one): for example, 2, 3, 5, 7, 11, 13, 17, 19, 23, . . .

(ii) A *palindromic number* is a number which reads the same backwards as forwards: for example, 1234321, 78000087.

(ii) An *arithmetic progression* is a sequence of numbers, each member differing from the previous one by the same constant quantity: for example, 7, 10, 13, 16, . . . or, in general, a, a + d, a + 2d, a + 3d, . . . We ask the question: how long can an arithmetic progression be, which consists only of prime numbers (a PAP)?

It is conjectured that a PAP can be as long as we wish. The truth of this conjecture would readily follow from an improvement to a theorem of Endre Szemeredi (see *Acta Math Acad Sci Hungar*, vol 20 1969, pp 89-104).

Sierpinski defines g(x) to be the maximum number of terms in a PAP not greater than x. The least x, 1(x), can then be regarded as a function of g(x) yielding the following table:

g(x)	2	3	4	5	6 . . .
1(x)	3	7	23	29	157 . . .

The first column refers to the PAP 2, 3, while the fifth column refers to the PAP 7, 37, 67, 97, 127, 157.

It has been conjectured that there are arbitrarily long PAPs of: (a) consecutive primes such as 251, 257, 263, 269, and 1741, 1747, 1753, 1759; and (b) palindromic primes such as 13931, 14741, 15551 and 16361.

Paul Erdos has broadened the problem by conjecturing that if (a_i) is any infinite sequence of integers for which the sum of the reciprocals is divergent, then the sequence contains arbitrarily long arithmetic progressions. He offers a prize of $3000 for a proof or disproof of this conjecture.

Problem A List all the PAPs of a given length contained within a given table of prime numbers.

Tabulate separately those consisting of: (a) consecutive primes; and (b) palindromic primes.

Problem B Extend Sierpinski's table of 1(x) as a function of g(x), printing the PAP to which each entry corresponds.

Problem C Investigate the Erdos conjecture for various sequences (a_i) whose reciprocals have a divergent sum.

Readers are invited to submit their attempts at some (or all) of the above problems to: Mike Mudge, C/- *APC*, 2nd Floor, 215 Clarence Street, Sydney 2000.

Submissions which must reach me by 25 August 1986, will be judged using suitably vague criteria, and a prize will be awarded to the 'best' contribution received by the closing date.

January review

Euler's Constant, defined as the limit as n, tends to infinity of $(1/1 + 1/2 + 1/3 + \ldots + 1/n) - \log_e n = 0.577215664901532860606512090 \ldots$ (see for this, and many other interesting numbers. *A Handbook of Integer Sequences* by NJA Sloane, Academic Press 1973).

The conjecture that $4/n = 1/x + 1/y + 1/z$ could be solved in positive integers for all n greater than 1, has been verified for n less than or equal to 10^8 by Nicola Franceshine; the corresponding result for 5/n is explored up to n = 1057438801 by Stewart, who covers all n *not* of the form 278460k + 1.

There are many other problems — for example: 'What is known about sets of unequal, odd integers whose sum is unity, such as 3, 5, 7, 9, 15, 21, 27, 35, 63, 105, 135?' The interested reader is referred to *Diophantine Equations* by LJ Mordell, Academic Press 1969, and also to *Unsolved Problems in Number Theory* by RK Guy, Springer 1981.

The prize-winner this month is Henry Ibstedt who, in addition to suggesting that Folkman's Number is probably bigger than Skewes' Number, used his IBM PC with 256k RAM in Basic to discover 14 140-digit equal denominators in the sums S_{317} to S_{337}, and extended the search to S_{457}. No equal numerators exist between S_1 and S_{457}.

Henry implemented two methods of representing integers with different terms from the harmonic series, expressing 5 as the sum of 1920 such terms and 6 as the sum of 1658880 such terms.

Many other results and investigations were detailed in an extremely well-documented submission, resulting in a most worthy prize-winner.

Well done, Henry. END

USER GROUPS INDEX

Below is a list of updates and additions to the full User Group Index published in the June issue of APC. The next full listing will appear in the December issue of APC.

NEW SOUTH WALES

The President Computers User Group has recently been formed and caters for President and other IBM PC/AT compatibles. Meetings are held on the last Tuesday of each month (except December), at the Hornsby Inn, (Claude Fays Hotel), 29 Florence Street, Hornsby, commencing at 8pm. For more details contact Raymond or Tricia Toms (02) 456 3756 or Rick West (02) 872 4177.

QUEENSLAND

For details about The Brisbane Apple User Group write to the Secretary, The Brisbane Apple User Group, PO Box 721, South Brisbane Qld 4101.

Details of the Ad Lib VeeZed Micro Club may be obtained by writing to Gordon Browell, Ad Lib VeeZed Micro Club, 13 Brookes Street, Biggenden Qld 4621.

The Queensland Atari Computer Enthusiasts (QACE), has recently changed its mailing address to PO Box 17, Acacia Ridge, Qld 4169. The Club meets on the third Wednesday of each month at the Yeronga State School, Park Road, Yeronga, commencing at 7.30pm.

END

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MS-DOS programmes are aimed at the IBM-PC and close compatibles. The NEC APC III will often require the software library extension card to be able to execute these programmes.

Documentation is included on the disks where required — often it is very extensive. Unfortunately, we are unable to provide telephone tutorials on using the programmes.

MS-DOS disks are formatted for standard MS-DOS 2.11 360K. Testing has been carried out for CP/M disks on a Z80 Kaypro II.

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CP2 **GAME.** A 191k version of Adventure, the classic game which can absorb your attention for days at a time. This is a 550 pt version with an expanded cave and smarter creatures.

CP3 **GAMES.** More fascinating games to absorb time you can't spare — such as a six level chess game, Othello, a well-written multi-level version of Pacman and an extensive Wumpus adventure game.

CP4 **GAMES.** Some outstanding games written in Mbasic, with source. Includes golf, a hunting game (like space invaders) called Duck where the ducks fight back, and a super adventure game where you can choose your personal strengths. Also contains a keyboard translator like Smartkey.

CP21 **UTILITIES.** A whole heap of useful programmes to catalogue your files, arrange the directory display, make emergency alterations to the disk, allow printing and computing at same time, count words, print the screen, copy better, erase, unerase, delete, make batch commands, etc.

CP28 **UTILITIES.** A super collection of some of the best uitilities available, such as NEWSWEEP, NULU (file library), SUPERZAP and VDO-KP.

CP62 **GRAPHICS BAR-GRAPH GENERATOR.** Provides 3-D graphs using ASCII (non-video) for screen and printer. (A video version (CP62B) is also available set up for recent Kaypros).

CP81 **LANGUAGE — FORTH.** This is the famous F83, which adopts the latest Forth standard. Has built-in editor, compiler, etc.

CP82A **LANGUAGE — SMALL C COMPILER, VERSION 2.1.** Inexpensive way of learning to use C. A published handbook is widely available.

CP83 **LANGUAGE — SMALL C LIBRARY.** Contains 105 C functions, many described in Jim Hendrix's "Small C Handbook". A lot are written in assembler and most are OK for any CP/M system.

CP84 **TURBO PASCAL UTILITIES.** Enhance your programming with listing, sorting, printing, auto-menu and mathematical functions, etc.

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CP101 **COMMUNICATIONS. TURBO PASCAL BULLETIN BOARD.** A complete bulletin board package that has been highly praised by users.

CP102 **COMMUNICATIONS. MDM730.** A popular and widely used system. Easily adapted to different machines. Source code and extensive documentation is included. An Apple/CPM version is also available.

CP141+ **DBASEII APPLICATIONS.** A powerful collection of 5 disks with fully developed applications packages, programme extensions, and algorithms. Includes super mail-management, inventory control, phone tracking, budgetting, graph-making facilities, patches, checking for duplicate entries, menu creation, and many more. $50 the set instead of $75.

CP501+ **MICROBEE SELECTION.** A set of three disks of utilities and games that have been tested on the Microbee. Dozens of utilities. Dozens of games, including Adventure. Many with source code. $30 for 3 disks instead of $45.

MS/DOS

M5 **GAMES. SUPER COMPILED GAMES.** Eight arcade games for those with colour graphics adaptor. Very absorbing. Includes Pango, Gold, Pyramid, 3-Demon, etc.

M6 **GAMES CHESS.** Several extensive compiled versions of this well-written game are on the disk. Easy to use, with good documentation and attractive graphics.

M7 **GAME/EDUCATION. PIANO COMPOSER AND GAME.** Allows you to compose music at the keyboard and playback songs on the disk. Good graphics. Requires IBM or close compatible.

M21 **UTILITIES.** These are essential and include file maintenance superstars like SWEEP and WASH as well as library and squeeze/unsqueeze programmes. Lots of them.

M22 **UTILITIES WITH ASSEMBLER/DISASSEMBLER.** Has a ramdisk programme, print while you work spooler, wordstar converter, as well as assembler/disassembler.

M23 **UTILITIES.** Make life easier for yourself with programmes like Util, Z, Vtype, ST, Protect, Unprotect.

M24 **UTILITIES.** Ultra Utilities can unerase files, patch, optimise Basic source code, generate Basic code for custom data bases, and more.

M26 **UTILITIES FOR PERSONAL MANAGEMENT.** Similar to Sidekick, these are background utilities that provide calculator, notepad/editor, phone index, alarm clock, calendar, printer controls, typewriter simulator, window access to directory, display/remove/copy/rename files, etc.

M41 **WORD PROCESSOR.** Considered at least as good as the commercial programmes. Contains PC-Write latest version (2.55) plus extensive manuals. For editing and formatting.

M42 **EDUCATION. TYPING TUTOR.** Also includes some fine programmes for maths/finance/physics calculations, showing formulae and results.

M61 **GRAPHICS.** A selection of some of the best programmes in the public domain, including an extensive picture-graphics set of commercial standard).

M82 **LANGUAGE. SMALL C:PC VERSION 1.1.** Ron Cain's compiler for those interested in learning the C language.

M85 **LANGUAGE — PASCAL.** One of the most popular languages for general programming. Well documented. A very good choice for learning to programme.

M101 **COMMUNICATIONS. MODEMS.** Two major communication programmes— Qmodem and Kermit. Lots of bells and whistles.

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MICROCHESS

END ZONE

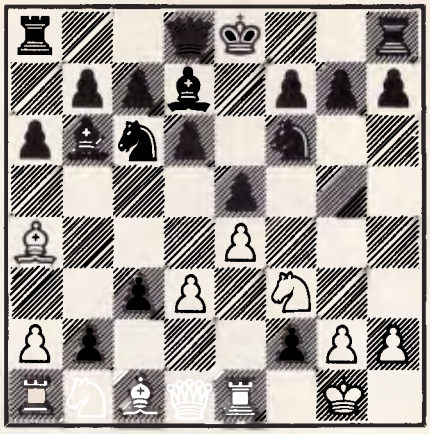
Kevin O'Connell describes some of Hitech's subtle moves.

I have featured Hitech in this column before. This program/machine from Carnegie-Mellon University in the US is making great strides in the field of computer chess, and is almost certain to emerge victorious in the World Computer Championship, which is being played in Cologne from 11-15 June.

In the 1985 Fredkin Masters Invitational Tournament, played in Hitech's home-town of Pittsburgh, Hitech fared very well indeed in the first allmaster tournament that a program has ever played in. The results were: 1 Rao 8 out of 8; 2 Szmetan 6½; 3 Hitech 5½; 4 Leveratt 5; 5-6 Magar, Nowe 3; 7 Martinak 2½; 8 Eidemiller 1½; 9 Nedved 1. This result was especially impressive as almost all the players had competed against computers before, and several of them had experience of playing Hitech itself.

The following game, from the Fredkin competition, shows Hitech demonstrating some surprisingly subtle positional understanding.

White: Charles Nowe. Black: Hitech. Opening: Italian Game.



Chessboard 1

1	e2–e4	e7–e5
2	Ng1–f3	Nb8–c6
3	B f1–c4	Bf8–c5
4	0–0	Ng8–f6
5	d2–d3	d7–d6
6	c2–c3	Bc5–b6
7	Bc4–b5	

An unusual move, allowing the game to transpose into a kind of Spanish Opening.

7	. . .	Bc8–d7
8	Rf1–e1	a7–a6
9	Bb5–a4	
9	. . .	Bb6–a5

A surprising move from a computer program. The bishop's mobility is reduced, but the positional thinking is very subtle, freeing the b-pawn and leaving the black bishop on what will be a good square in the kind of position that will arise.

10	Nb1–d2	b7–b5
11	Ba4–b3	0–0

Chessboard 2

MICROCHESS

12	Nd2–f1	b5–b4

Again, remarkable play by the computer, consistently following a good positional plan.

13	Bc1–d2	b4xc3
14	b2xc3	Ba5–b6

I am inclined to believe that Hitech played this move to tempt its opponent into what follows.

15	Bd2–g5	h7–h6
16	Bg5–h4	Bb6–a5
17	Ra1–c1	Nc6–a7

To pile up on White's c-pawn.

18	Nf1–e3	

Re1–e2 or Bb3–a4 would have been more prudent.

18	. . .	Na7–b5
19	Qd1–d2	Nb5–d4!

Another excellent positional stroke, since 20 Qd2–d1 would permit Black to eliminate White's light-squared bishop.

20	Nf3xd4	e5xd4
21	Ne3–d5	g7–g5
22	Bh4xg5	

22 Bh–g3 would be met simply by 22 . . . Nf6xd5 23 e4xd5 Ba5xc3, winning an exchange as well as the pawn.

22	. . .	d4xc3

Not 22 . . . h6xg5 23 Qd2xg5+, and 24 Nd5xf6 forces mate or wins the queen.

23	Rc1xc3	

If the queen moves along the diagonal, then Black can take on d5. Nd5xc3 would permit Black to take the bishop on g5.

23	. . .	Ba5xc3
24	Qd2xc3	Nf6xd5
25	Bb3xd5	Qd8xg5

Black emerges comfortably with some extra material, and still has plenty of positional pressure.

26	Bd5xa8	Bd7–h3
27	e4–e5	Rf8xa8
28	Qc3–c6	Ra8–b8
29	Kg1–f1	Bh3–f5
30	Qc6xc7	Rb8–c8
31	Qc7xd6	Qg5–d2

White has picked up two pawns for the piece, but this is killing.

31	Re1–b1	Bf5xd3+

0–1 (White resigns) END

LAZING AROUND

Brain-teasers courtesy of JJ Clessa.

Quickie

Which temperature reads the same in degrees Celsius as it does in Fahrenheit? (No postcards, please).

Prize puzzle

Consider the sequence of prime numbers: 3, 31, 431, 5431, 54319, and so on.

Each successive prime number is formed by adding one digit to the front or to the end of the preceding number. Each digit added is different from those already present.

What is the largest possible prime number that can be obtained by this procedure?

Leading zeros are not permitted, so it should be clear that the largest prime possible cannot contain more than nine digits.

Answers (including the sequence used) on postcards only please, to reach *APC*, 2nd Floor, 215 Clarence Street Sydney 2000, not later than 15 August 1986.

April prize puzzle

A good entry for this puzzle — 125 in all, of which 71 had the correct solution which is 8, 4, 2.

I did ask for three different digits, which accounts for why almost 25 per cent of the entries were incorrect.

The winning entry came from Hazel Green of Oakey, Queensland. Congratulations, Ms Green, your prize is on its way.

END

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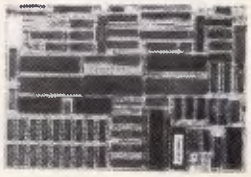

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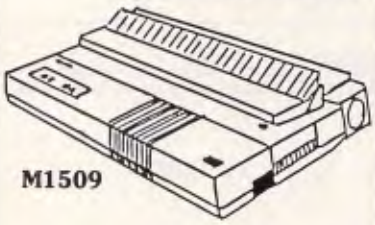

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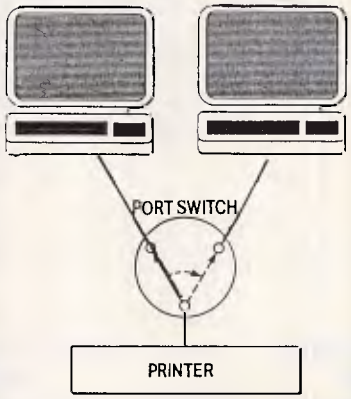

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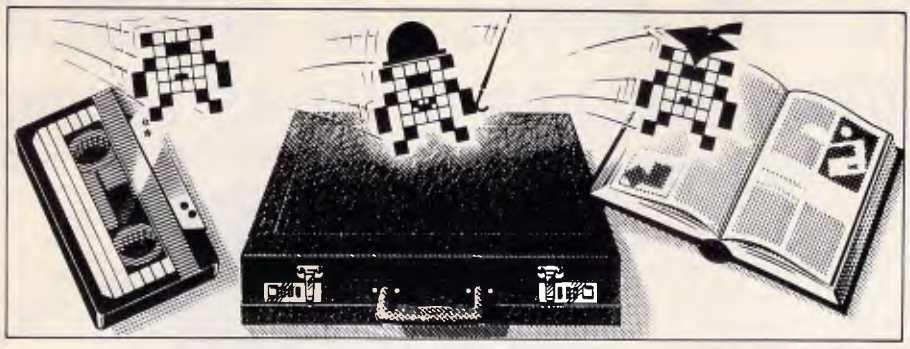

- ***Games***
- ***Scientific/mathematic***
- ***Business***
- ***Toolkit/utilities***
- ***Educational/Computer Aided Learning***

Owen Linderholm selects the best of readers' programs. For details on submitting your own, see the end of this section.

I have received a huge number of submissions for the Amstrad computers, both the CPC range and the PCW8256. The more interesting programs are for the CPC range, but I expect this will change as PCW8256 owners get to grips with their machines.

The Program of the Month is for the CPC 464, and is a Basic Compiler by Stephen Devine. It has not been tested on the 664 or the 6128, but should work without modification. Although the program only compiles a subset of Basic, it is extremely worthwhile for speeding up your programs. It compiles the code fairly quickly, and produces machine code programs which run at least six times as fast as the original Basic. While testing the program, I tried the *APC* Benchmarks to get some idea of how much the compiler speeded them up (Fig 2). As I was using a watch that only counted seconds, times are approximate. It was not possible to run Benchmarks six through eight because the compiler does not handle arrays.

Stephen Devine's compiler is a marvel of brevity and efficiency. It does not really compare with the better commercial compilers, but for many purposes it will work superbly. Although it omits many of the functions and commands in Basic, so do most commercial compilers, but this does not detract too much from its usefulness. Many Basic programs can be compiled with no modification; many will only require minor changes to variable names, and the like. Exact details of what is necessary are given in the program instructions.

No Basic compiler can compare with the performance that can be achieved from a language that is *meant* to be compiled, such as Pascal or C. Nevertheless, most people using micros learn programming in Basic and stay with it. There seems little point in rewriting a program in another language in order to compile it, if a Basic program need only be slightly changed in order that a Basic compiler can work on it.

Stephen Devine's program is quite compact and looks undecipherable, but on closer inspection it should be possible to understand how it works and even improve on it, to support features that Stephen hasn't included.

For the BBC, there is a program to provide alternative fonts or typefaces for display and printing. These can be accessed by the function keys while you are doing other things. The program is only 512 bytes long, and achieves this facility by dynamically redefining each character as it is about to be printed. It should be possible to incorporate this program into other programs so that the typefaces are permanently available. As the typefaces are changed as required, rather than being stored in memory, they are limited to incorporate simple but effective changes to the standard BBC font.

Following on from last month's Spectrum animation program, this month there is another program concerned with graphics and animation. The program is called Globeplotter, and it transposes a Spectrum screen onto the surface of a sphere. In fact, it transposes half the screen onto the surface of a sphere and then repeats, moving a predetermined step across the screen, producing the effect of a spinning globe. The main routine of the program is in machine code, but uses look-up tables calculated by the Basic part of the program. The author has used the program with other Z80-based machines. Example output from Spectrum Globetrotter is shown at the end of the listing.

Other listings include a generic Basic logarithmic plotting routine, a useful tip for CP/M users, an Amstrad 'fill' subroutine and a stock market analyser for the Commodore 64 from the ever-productive Kevin Riordan.

Benchmark	Compiled version	Basic version
1	<1 sec.	>2 sec.
2	<1 sec.	4 sec.
3	1 sec.	10 sec.
4	1 sec.	11 sec.
5	<2 sec.	12 sec.

Fig 2 Results of APC Benchmarks for Amstrad Basic Compiler

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Program of the Month

Amstrad Basic Compiler

by Stephen Devine

This Basic compiler enables programs written in Amstrad Basic to be compiled directly into machine code. This invariably results in faster and more compact programs.

Over 50 Basic keywords are supported by the compiler (including those dealing with sound and graphics), but there are some restrictions on the use of variables and expressions.

To use the compiler, type in the listing exactly as shown (except that all REM statements may be omitted if desired) and save it to tape or disk. (If saving to disk on the CPC464, be sure to save it as an ASCII file — otherwise you will not be able to merge it later.) Next, load or type in the program you wish to compile, and test it thoroughly under Basic.

When you are satisfied with the program's performance, you should then save it in case you wish to modify it at a later date. You must now renumber it so that the last line number is less than 1000, and ensure that the last line of the program terminates with an END statement.

Now merge in the compiler itself (if you don't still have it in memory) and run it using RUN 1000; this may take a few minutes if your program is very long, but the compiler will keep you informed of its progress at each stage. If any errors are reported, you should correct the offending line and re-compile from the beginning.

When your program has been successfully compiled, you may save it to tape or disk as a binary file (using the addresses generated at the end of the compilation) or run it immediately by CALLing the start address.

The accepted commands, together with any limitations, are shown below:

BORDER As Basic.

CALL No parameters allowed — only the address to call.

CLEAR No parameters allowed — simply clears all variables to zero.

CLG As Basic.

CLS As Basic.

DRAW/DRAWR As Basic.

END As Basic.

ENT/ENV As Basic.

FOR . . .NEXT As Basic, except that the loop must not be jumped out of, and each NEXT (which must *not* be followed by a variable) will always refer to the most recent FOR.

GOTO/GOSUB As Basic, except that the ON . . . GOTO and ON . . .GOSUB structures are not supported.

IF . . . THEN As Basic but no ELSE statement allowed, and statements such as IF . . . THEN (line number) must be written as IF . . . THEN GOTO (line number).

INK As Basic.

LET As Basic — that is, optional.

LOCATE As Basic.

MODE As Basic.

MOVE/MOVER As Basic.

ORIGIN As Basic — that is, both ORIGIN x,y and ORIGIN x,y,l,r,t,b are supported.

PAPER As Basic.

PEN As Basic.

PLOT/PLOTR As Basic.

POKE As Basic.

PRINT As Basic, except only one argument allowed (number, variable or quoted string) per PRINT statement. A semi-colon may be appended as in Basic, but not a comma. If the argument is preceded by #n, (where n is a number between 0 and 8), output will be directed to the appropriate screen window (or to the printer if #8 is used).

REM As Basic — the remainder of the line is entirely ignored by the compiler.

RELEASE As Basic.

RETURN As Basic.

RUN As Basic, but no line number allowed. To simulate RUN 100, use CLEAR : GOTO 100.

SOUND As Basic.

TAG/TAGOFF As Basic.

WHILE/WEND As Basic, but loop must not be jumped out of.

WINDOW As Basic, including WINDOW SWAP.

The following Basic functions are also supported:

ABS As Basic.

CHR$ As Basic, but only accepted in PRINT statements.

INKEY$ Used in the form I = INKEY$ — equivalent to Basic I = ASC(INKEY$). Note that if no key is pressed, INKEY$ returns a value of –1.

JOY As Basic.

NOT Argument must be enclosed in parentheses.

PEEK As Basic.

POS/VPOS As Basic.

RND No argument permitted. Returns an integer result between –32768 and +32767.

SGN As Basic.

TEST/TESTR As Basic.

XPOS/YPOS As Basic.

Where appropriate, statements may also include #n, (where n is a number between 0 and 7) to specify a particular screen window.

Only simple integer variables are supported, and these should consist of a single letter (A . . Z) or two identical letters (AA . . ZZ). Lower-case letters may be used if desired, but the compiler makes no distinction between these and capitals. Any numbers used must be integers between –32768 and +32767.

All the standard arithmetic and relational operators may be used (with the exception of ∧), but note that all expressions are evaluated from left to right, with no precedence of operators. This system may take some getting used to — especially if you are familiar with the method used by Basic — and care must be taken in formulating expressions to ensure that you achieve the desired result. For example, the expression A = 2 + 4 * 3 will yield a result of 14 in Basic, as it is evaluated as 2 + (4 * 3) (because * has a higher priority than +), but when compiled, the result would be 18, as by evaluating from left to right, the expression becomes A = (2 + 4) * 3.

To obtain the same result in Basic, the expression must be re-written as A = 2 + 4 (4 * 3) or A = 4 * 3 + 2.

Expressions of this kind will probably be easy to cope with, but it is all too easy to be misled by relational expressions such as IF A › B + 3 which will *not* be compiled as IF A › (B + 3), which is the case with Basic, but would yield the nonsensical result of IF(A › B) + 3.

As a general rule, expressions of this type should have the right-hand side of the inequality enclosed in parentheses.

Note also that where a minus occurs in an expression, it must be enclosed in brackets if it occurs immediately after another arithmetic or relational operator. Thus the statement PRINT –2 * 3 will correctly evaluate to –6, but the statement PRINT 3 * –2 should be written as PRINT 3 * (–2).

As an example of the speed im-

provement which can be obtained when using the compiler, try out the following one-line Basic program:

```
100 MODE 0 : WHILE b(400 : WHILE a(640 : PLOT a,b : a=a+4 : WEND : a =0 : b=b+2 : WEND : END
```

This program fills up the screen by plotting every individual point in the current pen colour. When run under Basic, it takes over three minutes to run, while the compiled version takes less than 20 seconds!

```
1 REM ********************************
2 REM *  Amstrad Basic Compiler      *
3 REM * (C) 1986  Stephen Devine     *
4 REM ********************************
5 REM
1000 GOSUB 5140: 'Initialize
1010 GOSUB 1060: 'Compile
1020 GOSUB 5250: 'Terminate
1030 END
1040 '
1050 'Compile
1060 GOSUB 4610:a=&170: 'Intialize machine code
1070 n=256*PEEK(a+1)+PEEK(a):IF n=0 THEN 1140
1080 n=a+n:l=256*PEEK(a+3)+PEEK(a+2):IF l>999 THEN 1140
1090 x=2*l+j:POKE x,m-256*INT(m/256):POKE x+1,INT(m/256)
1100 IF m>(HIMEM-200) THEN ee=9:GOTO 5430: 'Error
1110 LOCATE 1,6:PRINT"COMPILING LINE:";:PRINT l
1120 GOSUB 4320:b=PEEK(p): 'Pre-process line
1130 WHILE p<q:GOSUB 11B0:p=p+1:WEND:a=n:GOTO 1070
1140 IF e=0 THEN PRINT:PRINT"No END statement before Line 1000":GOTO 564
0
1150 RETURN
1160 '
1170 'Compile statement
1180 e=0:b=PEEK(p):IF b=1 THEN p=p+1:GOTO 1180
1190 IF b<12B THEN 2360
1200 IF b=165 THEN 2350 ELSE IF b=15B THEN 2410: 'LET,FOR
1210 IF b=176 THEN 2520 ELSE IF b=214 THEN 2550: 'NEXT,WHILE
1220 IF b=213 THEN 2600 ELSE IF b=161 THEN 2630: 'WEND,IF
1230 IF b=191 THEN 2690 ELSE IF b=204 THEN 2960: 'PRINT,SOUND
1240 IF b=153 OR b=154 THEN 3090: 'ENT,ENT
1250 IF b=192 OR b=197 THEN p=q+1:RETURN: 'REM
1260 GOSUB 4170:IF y>1 THEN 1420: 'Get no. of parameters
1270 IF b<>135 THEN 1300: 'CLG
1280  IF y=1 THEN GOSUB 3270:x=&CD7D:GOSUB 3230:x=&BBE4:GOSUB 3230
1290  POKE m,&CD:m=m+1:x=&BBD8:GOTO 3230
1300 IF b<>130 THEN 1340: 'CLS
1310  IF y=1 THEN GOSUB 3270:x=&CD7D:GOSUB 3230:POKE m,&B4:m=m+1:x=&F5BB
:GOSUB 3230
1320  POKE m,&CD:m=m+1:x=&BB6C:IF y=1 THEN GOSUB 3230:x=&CDF1:GOSUB 3230
:x=&BBB4
1330  GOTO 3230
1340 IF y=1 THEN 1420
1350 IF b=201 THEN x=&C9:GOTO 3200: 'RETURN
1360 IF b=208 THEN x=&FF3E:GOSUB 3230:POKE m,&CD:m=m+1:x=&BB63:GOTO 3230
: 'TAG
1370 IF b=209 THEN x=&CDAF:GOSUB 3230:x=&BB63:GOTO 3230: 'TAGOFF
1380 IF b=152 THEN e=-1:POKE m,&C3:m=m+1:x=c+&30:GOTO 3230: 'END
1390 IF b=134 THEN POKE m,&CD:m=m+1:x=c+&18:GOTO 3230: 'CLEAR
1400 IF b=202 THEN POKE m,&21:m=m+1:x=c+&220:GOSUB 3230:POKE m,&C3:m=m+1
:x=c+&10:GOTO 3230: 'RUN
1410 ee=1:GOTO 5430: 'Error
1420 IF y>2 THEN 1720
1430 IF b<>130 THEN 1470: 'BORDER
1440  GOSUB 3270:IF y=1 THEN x=&4D45:GOSUB 3230:GOTO 1460
1450  POKE m,&E5:m=m+1:GOSUB 3270:x=&45C1:GOSUB 3230
1460  POKE m,&CD:m=m+1:x=&BC38:GOTO 3230
1470 IF b<>1B6 THEN 1530: 'PAPER
1480  GOSUB 3270:IF y=1 THEN 1500
1490  x=&CD7D:GOSUB 3230:x=&BBB4:GOSUB 3230:POKE m,&F5:m=m+1:GOSUB 3270
1500  x=&CD7D:GOSUB 3230:x=&BB96
1510  IF y=2 THEN GOSUB 3230:x=&CDF1:GOSUB 3230:x=&BBB4
1520  GOTO 3230
1530 IF b<>1B7 THEN 1590: 'PEN
1540  GOSUB 3270:IF y=1 THEN 1560
1550  x=&CD7D:GOSUB 3230:x=&BBB4:GOSUB 3230:POKE m,&F5:m=m+1:GOSUB 3270
1560  x=&CD7D:GOSUB 3230:x=&BB90
1570  IF y=2 THEN GOSUB 3230:x=&CDF1:GOSUB 3230:x=&BBB4
1580  GOTO 3230
1590 IF y=2 THEN 1730
1600 IF b<>131 THEN 1620: 'CALL
1610  GOSUB 3270:x=&21E5:GOSUB 3230:x=m+4:GOSUB 3230:x=&E9E3:GOTO 3230
1620 IF b<>173 THEN 1640: 'MODE
1630  GOSUB 3270:x=&CD7D:GOSUB 3230:x=&BC0E:GOTO 3230
1640 IF b<>160 THEN 1670: 'GOTO
1650  p=p+1:GOSUB 40B0:IF x<1 OR x>999 THEN ee=6:GOTO 5430: 'Error
1660  POKE m,&C3:m=m+1:GOTO 3230
1670 IF b<>159 THEN 1700: 'GOSUB
1680  p=p+1:GOSUB 40B0:IF x<1 OR x>999 THEN ee=6:GOTO 5430: 'Error
1690  POKE m,&CD:m=m+1:GOTO 3230
1700 IF b<>196 THEN ee=1:GOTO 5430: 'RELEASE
1710  GOSUB 3270:x=&CD7D:GOSUB 3230:x=&BCB3:GOTO 3230
1720 IF y>3 THEN 2200
1730 IF b<>162 THEN 1770: 'INK
1740  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270: 'Evaluate
1750  IF y=2 THEN x=&4D45 ELSE POKE m,&E5:m=m+1:GOSUB 3270:x=&45C1
1760  GOSUB 3230:x=&7DE1:GOSUB 3230:POKE m,&CD:m=m+1:x=&BC32:GOTO 3230
1770 IF b<>169 THEN 1B40: 'LOCATE
1780  IF y=2 THEN 1800
1790  GOSUB 3270:x=&CD7D:GOSUB 3230:x=&BBB4:GOSUB 3230:POKE m,&F5:m=m+1
1800  GOSUB 3270:POKE m,&E5:m=m+1
1B10  GOSUB 3270:x=&61C1:GOSUB 3230:POKE m,&CD:m=m+1:x=&BB75
1820  IF y=3 THEN GOSUB 3230:x=&CDF1:GOSUB 3230:x=&BBB4
1B30  GOTO 3230
1B40 IF b<>14B THEN 1B90: 'DRAW
1B50  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270:IF y=2 THEN 1BB0
1B60  POKE m,&E5:m=m+1:GOSUB 3270
1B70  x=&CD7D:GOSUB 3230:x=&BBDE:GOSUB 3230:POKE m,&E1:m=m+1
1BB0  x=&CDD1:GOSUB 3230:x=&BBF6:GOTO 3230
1B90 IF b<>149 THEN 1940: 'DRAWR
1900  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270:IF y=2 THEN 1930
1910  POKE m,&E5:m=m+1:GOSUB 3270
1920  x=&CD7D:GOSUB 3230:x=&BBDE:GOSUB 3230:POKE m,&E1:m=m+1
1930  x=&CDD1:GOSUB 3230:x=&BBF9:GOTO 3230
1940 IF b<>188 THEN 1990: 'PLOT
1950  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270:IF y=2 THEN 19B0
1960  POKE m,&E5:m=m+1:GOSUB 3270
1970  x=&CD7D:GOSUB 3230:x=&BBDE:GOSUB 3230:POKE m,&E1:m=m+1
1980  x=&CDD1:GOSUB 3230:x=&BBEA:GOTO 3230
1990 IF b<>1B9 THEN 2040: 'PLOTR
2000  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270:IF y=2 THEN 2030
2010  POKE m,&E5:m=m+1:GOSUB 3270
2020  x=&CD7D:GOSUB 3230:x=&BBDE:GOSUB 3230:POKE m,&E1:m=m+1
2030  x=&CDD1:GOSUB 3230:x=&BBED:GOTO 3230
2040 IF y<>2 THEN ee=1:GOTO 5430: 'Error
2050 IF b<>174 THEN 20B0: 'MOVE
2060  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270
2070  x=&CDD1:GOSUB 3230:x=&BBC0:GOTO 3230
2080 IF b<>175 THEN 2110: 'MOVER
2090  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270
2100  x=&CDD1:GOSUB 3230:x=&BBC3:GOTO 3230
2110 IF b<>190 THEN 2140: 'POKE
2120  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270
2130  x=&E17D:GOSUB 3230:x=&77:GOTO 3200
2140 IF b<>184 THEN 2170: 'ORIGIN x,y
2150  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270
2160  x=&CDD1:GOSUB 3230:x=&BBC9:GOTO 3230
2170 IF b<>216 OR b<>231 THEN ee=1:GOTO 5430: 'WINDOW SWAP
2180  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270
2190  x=&45C1:GOSUB 3230:POKE m,&CD:m=m+1:x=&BBB7:GOTO 3200
2200 IF y>5 THEN 2290
2210 IF b<>216 THEN ee=1:GOTO 5430: 'WINDOW
2220  GOSUB 3270: 'Evaluate
2230  IF y=5 THEN x=&CD7D:GOSUB 3230:x=&BBB4:GOSUB 3230:POKE m,&F5:m=m+1
2240  GOSUB 3270:x=&E52B:GOSUB 3230:GOSUB 3270:x=&E52B:GOSUB 3230
2250  GOSUB 3270:x=&E52B:GOSUB 3230:GOSUB 3270:x=&D12B:GOSUB 3230
2260  x=&61C1:GOSUB 3230:x=&51C1:GOSUB 3230:POKE m,&CD:m=m+1:x=&BB66
2270  IF y=5 THEN GOSUB 3230:x=&CDF1:GOSUB 3230:x=&BBB4
2280  GOTO 3230
2290 IF y<>6 THEN ee=1:GOTO 5430: 'Error
2300 IF b<>184 THEN ee=1:GOTO 5430: 'ORIGIN
2310  GOSUB 2150:GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270
2320  x=&CDD1:GOSUB 3230:x=&BBCF:GOSUB 3230
2330  GOSUB 3270:POKE m,&E5:m=m+1:GOSUB 3270
```

```
2340  x=&CDD1:GOSUB 3230:x=&BBD2:GOTO 3230
2350 p=p+1: 'LET
2360 IF PEEK(p)<>14 THEN ee=10:GOTO 5430: 'Error
2370 p=p+1:b=PEEK(p):IF b<&41 OR b>&74 THEN ee=3:GOTO 5430: 'Error
2380 v=2*(b-&41)+c+&150:p=p+1:IF PEEK(p)<>239 THEN ee=11:GOTO 5430: 'Err
or
2390 GOSUB 4170:IF y<>1 THEN ee=2:GOTO 5430: 'Error
2400 GOSUB 3270:POKE m,&22:m=m+1:x=v:GOTO 3230
2410 p=p+1:IF PEEK(p)<>14 THEN ee=12:GOTO 5430: 'FOR
2420 p=p+1:b=PEEK(p):IF b<&41 OR b>&5A THEN ee=3:GOTO 5430: 'Error
2430 v=2*(b-&41)+c+&150:p=p+1:IF PEEK(p)<>239 THEN ee=11:GOTO 5430: '
2440 GOSUB 3270:IF PEEK(p)<>236 THEN ee=15:GOTO 5430: 'TO
2450 x=&222B:GOSUB 3230:x=v:GOSUB 3230
2460 x=m:POKE m,&21:m=m+1:GOSUB 3230:POKE m,&E5:m=m+1
2470 GOSUB 4170:IF y<>1 THEN ee=2:GOTO 5430: 'Error
2480 GOSUB 3270:x=&5BED:GOSUB 3230:x=v:GOSUB 3230
2490 POKE m,&13:m=m+1:x=&53ED:GOSUB 3230:x=v:GOSUB 3230
2500 POKE m,&B7:m=m+1:x=&52ED:GOSUB 3230:x=&DAE1:GOSUB 3230
2510 u=u+2:POKE u,m-256*INT(m/256):POKE u+1,INT(m/256):m=m+2:x=&E5:GOTO
3200
2520 POKE m,&C9:m=m+1:x=256*PEEK(u+1)+PEEK(u):u=u-2: 'NEXT
2530 IF u<pp+600 THEN ee=17:GOTO 5430: 'Error
2540 POKE x,m-256*INT(m/256):POKE x+1,INT(m/256):RETURN
2550 GOSUB 4170:IF y<>1 THEN ee=2:GOTO 5430: 'WHILE
2560 x=m:POKE m,&21:m=m+1:GOSUB 3230:POKE m,&E5:m=m+1
2570 GOSUB 3270:x=&B57C:GOSUB 3230:x=&CAE1:GOSUB 3230
2580 w=w+2:POKE w,m-256*INT(m/256):POKE w+1,INT(m/256)
2590 m=m+2:x=&E5:GOTO 3200
2600 POKE m,&C9:m=m+1: 'WEND
2610 x=256*PEEK(w+1)+PEEK(w):w=w-2:IF w<pp+500 THEN ee=18:GOTO 5430: 'Er
ror
2620 POKE x,m-256*INT(m/256):POKE x+1,INT(m/256):RETURN
2630 GOSUB 4170:IF y<>1 THEN ee=2:GOTO 5430: 'IF
2640 GOSUB 3270:IF PEEK(p)<>235 THEN ee=16:GOTO 5430: 'THEN
2650 x=&B57C:GOSUB 3230:x=&320:GOSUB 3230:POKE m,&C3:m=m+1
2660 x=256*PEEK(n+3)+PEEK(n+2):GOTO 3230
2670 '
2680 'PRINT
2690 f=0:p=p+1:IF PEEK(p)<>35 THEN 2750: '#
2700  GOSUB 3270:x=&FE7D:GOSUB 3230:x=&2008:GOSUB 3230
2710  x=&3E06:GOSUB 3230:x=&3201
2720  GOSUB 3230:x=c+&141:GOSUB 3230:x=&CDAF:GOSUB 3230
2730  x=&BBB4:GOSUB 3230:POKE m,&F5:m=m+1
2740  f=-1:IF PEEK(p)=44 THEN p=p+1: ',
2750 IF PEEK(p)=34 THEN 2830
2760  p=p-1:GOSUB 4170:IF y=0 THEN 2810
2770  IF y<>1 THEN ee=2:GOTO 5430: 'Error
2780  IF PEEK(p+1)<>255 OR PEEK(p+2)<>3 THEN 2800: 'CHR$
2790   p=p+2:GOSUB 3270:x=&CD7D:GOSUB 3230:x=c+&140:GOSUB 3230:GOTO 2810
2800  GOSUB 3270:POKE m,&CD:m=m+1:x=c+&F8:GOSUB 3230
2810  IF PEEK(p)<>59 THEN POKE m,&CD:m=m+1:x=c+&130:GOSUB 3230:p=p+1: 'C
RLF
2820  GOTO 2910
2830 POKE m,&CD:m=m+1:x=c+&D0:GOSUB 3230
2840 p=p+1:b=PEEK(p):IF b=34 THEN 2870
2850 IF b=1 OR b=0 THEN 2900
2860 POKE m,b:m=m+1:GOTO 2840
2870 p=p+1:b=PEEK(p):IF b=59 THEN 2900
2880 IF b<>1 AND b<>0 THEN ee=5:GOTO 5430: 'Error
2890 x=&A0D:GOSUB 3230
2900 x=0:GOSUB 3200
2910 IF f=0 THEN RETURN
2920 x=&32AF:GOSUB 3230:x=c+&141:GOSUB 3230
2930 x=&CDF1:GOSUB 3230:x=&BBB4:GOSUB 3230:f=0:RETURN
2940 '
2950 'SOUND
2960 GOSUB 4170:IF y<2 OR y>7 THEN ee=2:GOTO 5430: 'Error
2970 POKE m,&CD:m=m+1:x=c+&1D0:IF v>4 THEN x=c+&1DB
2980 GOSUB 3230:GOSUB 3270:x=&327D:GOSUB 3230:x=c+&20B:GOSUB 3230
2990 GOSUB 3270:POKE m,&22:m=m+1:x=c+&208+3:GOSUB 3230
3000 IF y>2 THEN GOSUB 3270:POKE m,&22:m=m+1:x=c+&208+7:GOSUB 3230
3010 IF y>3 THEN GOSUB 3270:x=&327D:GOSUB 3230:x=c+&208+6:GOSUB 3230
3020 IF y>4 THEN GOSUB 3270:x=&327D:GOSUB 3230:x=c+&208+1:GOSUB 3230
3030 IF y>5 THEN GOSUB 3270:x=&327D:GOSUB 3230:x=c+&208+2:GOSUB 3230
3040 IF y>6 THEN GOSUB 3270:x=&327D:GOSUB 3230:x=c+&208+5:GOSUB 3230
3050 POKE m,&21:m=m+1:x=c+&20B:GOSUB 3230
3060 POKE m,&CD:m=m+1:x=&BCAA:GOTO 3230
3070 '
3080 'ENT or ENV
3090 GOSUB 4170:IF y<4 OR y>16 THEN ee=2:GOTO 5430: 'Error
3100 IF (y-1) MOD 3 <>0 THEN ee=2:GOTO 5430: 'Error
3110 POKE m,&3E:POKE m+1,y\3:m=m+2:POKE m,&32:m=m+1:x=c+&208:GOSUB 3230
3120 bb=b:GOSUB 3270:POKE m,&E5:m=m+1
3130 FOR k=0 TO (y\3)-1:FOR kk=1 TO 3
3140 GOSUB 3270:x=&327D:GOSUB 3230:x=3*k+kk+c+&208:GOSUB 3230:NEXT:NEXT
3150 x=&7DE1:GOSUB 3230:POKE m,&21:m=m+1:x=c+&208:GOSUB 3230:POKE m,&CD:
m=m+1
3160 IF bb=153 THEN x=&BCBF ELSE x=&BCBC: 'ENT or ENV
3170 GOTO 3230
3180 '
3190 'Compile single byte
3200 POKE m,x:m=m+1:RETURN
3210 '
3220 'Compile double byte
3230 IF x<0 THEN x=x+65536
3240 POKE m,x-256*(INT(x/256)):POKE m+1,INT(x/256):m=m+2:RETURN
3250 '
3260 'Compile expression
3270 ff=-1:s=pp+700:POKE s,0
3280 p=p+1:b=PEEK(p):IF b=35 THEN p=p+1:b=PEEK(p): '#
3290 IF b=28 THEN ff=0:GOSUB 4080:POKE m,&21:m=m+1:GOSUB 3230:GOTO 3530
3300 IF b=14 THEN ff=0:GOSUB 4120:POKE m,&2A:m=m+1:GOSUB 3230:GOTO 3530
3310 IF b=40 THEN ff=-1:s=s+1:POKE s,0:GOTO 3280
3320 IF b=254 THEN 3350
3330 IF b<>255 THEN 3420
3340  p=p+1:b=PEEK(p)
3350  ff=-1:IF PEEK(p+1)=40 THEN 3410: '(
3360   IF b=67 THEN POKE m,&CD:m=m+1:x=c+&1C0:GOSUB 3230:GOTO 3280: 'INK
EY$
3370   IF b=69 THEN POKE m,&CD:m=m+1:x=c+&40:GOSUB 3230:GOTO 3280: 'RND
3380   IF b=71 THEN x=&C6CD:GOSUB 3230:x=&EBBB:GOSUB 3230:GOTO 3280: 'XP
OS
3390   IF b=72 THEN x=&C6CD:GOSUB 3230:x=&BB:GOSUB 3200:GOTO 3280: 'YPOS
3400   ee=7:GOTO 5430: 'Error
3410  s=s+1:POKE s,b:s=s+1:POKE s,40:p=p+1:GOTO 3280
3420 IF b<>245 OR ff=0 THEN 3440
3430  ff=0:POKE m,&21:m=m+1:x=0:GOSUB 3230:p=p-1:GOTO 3530
3440 IF b>=238 AND b<=253 THEN 3470
3450 IF b<>44 THEN 3480
3460 IF PEEK(s)<>40 THEN 3510
3470 ff=-1:POKE m,&E5:m=m+1:s=s+1:POKE s,b:GOTO 3280
3480 IF b<>41 THEN 3510
3490 ff=0:s=s-1:IF PEEK(s+1)=0 THEN 3530
3500 b=PEEK(s):s=s-1:GOSUB 3800:GOTO 3530
3510 IF b<>0 AND b<>1 AND b<>44 AND b<>59 AND b<>235 AND b<>236 THEN ee=
5:GOTO 5430: 'Error
3520 IF s=(pp+700) THEN RETURN ELSE ee=4:GOTO 5430: 'Error
3530 IF PEEK(s)=0 OR PEEK(s)=40 THEN 3280
3540 IF PEEK(s)=44 THEN IF PEEK(p+1)<>41 THEN 3280
3550 POKE m,&D1:m=m+1:b=PEEK(s):s=s-1:GOSUB 3580:GOTO 3530
3560 '
3570 'Compile arithmetic or relational operator
3580 IF b=44 THEN RETURN: ',
3590 IF b<238 OR b>253 OR b=248 THEN 3610
3600 ON b-237 GOTO 3620,3640,3660,3670,3680,3690,3700,3710,3720,3730,361
0,3730,3740,3750,3760,3770
3610 ee=14:GOTO 5430: 'Error
3620 POKE m,&AF:m=m+1: '>
3630 x=&52ED:GOSUB 3230:x=&6F17:GOSUB 3230:x=&26:GOTO 3230
3640 POKE m,&AF:m=m+1:x=&52ED:GOSUB 3230:x=&120:GOSUB 3230: '=
3650 x=&6F3C:GOSUB 3230:x=&26:GOTO 3230
3660 x=&AF13:GOSUB 3230:GOTO 3630: '>=
3670 x=&AFEB:GOSUB 3230:GOTO 3630: '<
3680 POKE m,&AF:m=m+1:x=&52ED:GOSUB 3230:x=&128:GOSUB 3230:GOTO 3650: '<
>
3690 POKE m,&EB:m=m+1:GOTO 3660: '<=
3700 x=&19:GOTO 3200: '+
3710 x=&B7EB:GOSUB 3230:x=&52ED:GOTO 3230: '-
3720 POKE m,&CD:m=m+1:x=c+&70:GOTO 3230: '*
3730 POKE m,&CD:m=m+1:x=c+&A0:GOTO 3230: '/ or \
3740 x=&A47A:GOSUB 3230:x=&7B67:GOSUB 3230:x=&6FA5:GOTO 3230: 'AND
3750 POKE m,&CD:m=m+1:x=c+&A0:GOSUB 3230:x=&EB:GOTO 3200: 'MOD
3760 x=&B47A:GOSUB 3230:x=&7B67:GOSUB 3230:x=&6FB5:GOTO 3230: 'OR
3770 x=&AC7A:GOSUB 3230:x=&7B67:GOSUB 3230:x=&6FAD:GOTO 3230: 'XOR
```

```
3780 '
3790 'Compile function
3800 IF b<>254 THEN 3830: 'NOT
3810   x=&B57C:GOSUB 3230:x=&228:GOSUB 3230
3820   x=&FF3E:GOSUB 3230:x=&6F2F:GOSUB 3230:x=&26:GOTO 3230
3830 IF b<>30 THEN 3870: 'ABS
3840   x=&7CCB:GOSUB 3230:x=&728:GOSUB 3230
3850   x=&11:GOSUB 3230:x=&EB00:GOSUB 3230
3860   x=&EDB7:GOSUB 3230:x=&52:GOTO 3200
3870 IF b<>13 THEN 3910: 'JOY
3880   x=&CD5D:GOSUB 3230:x=&B824:GOSUB 3230
3890   x=&43CB:GOSUB 3230:x=&120:GOSUB 3230
3900   x=&266F:GOSUB 3230:x=0:GOTO 3200
3910 IF b=18 THEN x=&266E:GOSUB 3230:x=0:GOTO 3200: 'PEEK
3920 IF b<>20 THEN 3970: 'SGN
3930   x=&B57C:GOSUB 3230:x=&D28:GOSUB 3230
3940   x=&7CCB:GOSUB 3230:x=&620:GOSUB 3230
3950   x=&26:GOSUB 3230:x=&12E:GOSUB 3230
3960   x=&318:GOSUB 3230:x=&FF21:GOSUB 3230:x=&FF:GOTO 3200
3970 IF b<>120 AND B<>127 THEN 4020: 'POS or VPOS
3980   x=&CD7D:GOSUB 3230:x=&BBB4:GOSUB 3230
3990   x=&CDF5:GOSUB 3230:x=&BB78:GOSUB 3230
4000   x=&E5F1:GOSUB 3230:x=&B4CD:GOSUB 3230
4010   x=&E1BB:GOSUB 3230:IF b=120 THEN POKE m,&6C:m=m+1:x=&26:GOTO 3230
4020 IF b<>124 AND B<>125 THEN 4050: 'TEST or TESTR
4030   x=&F0CD:IF b=125 THEN x=&F3CD
4040   GOSUB 3230:x=&6FBB:GOSUB 3230:x=&26:GOTO 3230
4050 ee=7:GOTO 5430:'Error
4060 '
4070 'Fetch Number
4080 IF PEEK(p)<>28 THEN ee=13:GOTO 5430: 'Error
4090 x=256*PEEK(p+2)+PEEK(p+1):p=p+2:RETURN
4100 '
4110 'Fetch Variable Address
4120 IF PEEK(p)<>14 THEN ee=12:GOTO 5430: 'Error
4130 x=PEEK(p+1):IF x<&41 OR x>&74 THEN ee=3:GOTO 5430: 'Error
4140 x=2*(x-&41)+c+&150:p=p+1:RETURN
4150 '
4160 'Count number of Parameters
4170 y=0:x=p:z=0
4180 x=x+1:t=PEEK(x)
4190 IF t<>0 AND t<>1 THEN 4220
4200 IF p+1=x THEN RETURN
4210 ee=2:GOTO 5430: 'Error
4220 IF t=44 THEN ee=2:GOTO 5430: 'Error
4230 IF t=28 THEN x=x+2:GOTO 4280: 'number identifier
4240 IF t=&28 THEN z=z+1:GOTO 4280: '(
4250 IF t=&29 THEN z=z-1:GOTO 42B0: ')
4260 IF t=0 OR t=1 THEN 4290: 'eol or :
4270 IF z=0 THEN IF t=&2C THEN y=y+1:GOTO 4180
4280 x=x+1:t=PEEK(x):GOTO 4230
4290 IF z=0 THEN y=y+1:RETURN ELSE ee=4:GOTO 5430: 'Error
4300 '
4310 'Pre-process line
4320 p=pp:e=0:f=0:POKE p-1,0
4330 FOR i=a+4 TO n-1
4340   b=PEEK(i):IF PEEK(i-1)=255 THEN IF b=0 THEN b=30:GOTO 4570 ELSE 4
570
4350   IF b=34 THEN f=1-f:GOTO 4570
4360   IF b=1 THEN f=0:GOTO 4570
4370   IF f=1 THEN 4570
4380   IF b=32 THEN 4580 ELSE IF b=3 THEN b=2
4390   IF b=2 OR b=13 THEN 4410
4400   IF b<>11 AND b<>12 THEN 4470
4410    i=i+3:b=PEEK(i):IF b>=128 THEN t=0:GOTO 4440
4420    i=i+1:b=PEEK(i):IF b-128<>PEEK(i-1) THEN ee=3:GOTO 5430: 'Error
4430    t=26
4440    POKE p,14:p=p+1:b=b-128:IF b>&5A THEN b=b-&20
4450    b=b+t:IF b<&41 OR b>&74 THEN ee=3:GOTO 5430: 'Error
4460    GOTO 4570
4470   IF b<14 OR b>31 THEN 4570
4480   IF b>26 THEN 4520
4490    IF b<25 THEN x=b-14:GOTO 4560
4500    IF b=25 THEN i=i+1:x=PEEK(i):GOTO 4560
4510    b=28
4520   IF b<27 OR b>30 THEN ee=8:GOTO 5430: 'Error
4530    i=i+1:x=256*PEEK(i+1)+PEEK(i):i=i+1
4540    IF b=29 THEN x=256*PEEK(x+4)+PEEK(x+3)
4550    IF x<(-32768) OR x>32767 THEN ee=8:GOTO 5430: 'Error
4560    POKE p,2B:p=p+1:POKE p,x-256*INT(x/256):p=p+1:b=INT(x/256)
4570    POKE p,b:p=p+1
4580 NEXT i:POKE p,0:q=p-1:p=pp:RETURN
4590 '
4600 'Initialize machine code
4610 PRINT:PRINT"Initializing Machine Code..."
4620 m=c
4630 x=&73ED:GOSUB 3230:x=c+&3C:GOSUB 3230:x=&DCD:GOSUB 3230:x=&22BD:GOS
UB 3230
4640 x=c+&3E:GOSUB 3230:x=&21:GOSUB 3200:x=c+&220:GOSUB 3230
4650 m=c+&10:x=&7BED:GOSUB 3230:x=c+&3C:GOSUB 3230:POKE m,&E5
4660 m=c+&18:x=&21:GOSUB 3200:x=c+&150:GOSUB 3230:x=&11:GOSUB 3200:x=c+&
151
4670 GOSUB 3230:x=&36:GOSUB 3230:x=&6701:GOSUB 3230:x=&ED00
4680 GOSUB 3230:x=&C9B0:GOSUB 3230
4690 m=c+&30:x=&7BED:GOSUB 3230:x=c+&3C:GOSUB 3230:POKE m,&C9
4700 m=c+&40:x=&2A:GOSUB 3200:x=c+&3E:GOSUB 3230:x=&29E5:GOSUB 3230:x=&2
929
4710 GOSUB 3230:GOSUB 3230:x=&D129:GOSUB 3230:x=&1119:GOSUB 3230:x=&29
4720 GOSUB 3230:x=&2219:GOSUB 3230:x=c+&3E:GOSUB 3230:POKE m,&C9
4730 m=c+&58:x=&7CCB:GOSUB 3230:x=&C4:GOSUB 3200:x=c+&60:GOSUB 3230:POKE
 m,&C9
4740 m=c+&60:x=&4D44:GOSUB 3230:x=&21:GOSUB 3230:x=&B700:GOSUB 3230
4750 x=&42ED:GOSUB 3230:x=&C937:GOSUB 3230
4760 m=c+&70:x=&AC7A:GOSUB 3230:x=&CDF5:GOSUB 3230:x=c+&58:GOSUB 3230:x=
&CDEB
4770 GOSUB 3230:x=c+&58:GOSUB 3230:x=&7D4C:GOSUB 3230:x=&21:GOSUB 3230:x
=&600

4780 GOSUB 3230:x=&CB10:GOSUB 3230:x=&1F39:GOSUB 3230:x=&130:GOSUB 3230:
x=&EB19
4790 GOSUB 3230:x=&EB29:GOSUB 3230:x=&F510:GOSUB 3230:x=&17F1:GOSUB 3230
4800 x=&DC:GOSUB 3200:x=c+&60:GOSUB 3230:POKE m,&C9
4810 m=c+&A0:x=&AC7A:GOSUB 3230:x=&CDF5:GOSUB 3230:x=c+&58:GOSUB 3230:x=
&CDEB
4820 GOSUB 3230:x=c+&58:GOSUB 3230:x=&4D7C:GOSUB 3230:x=&21:GOSUB 3230:x
=&600

4830 GOSUB 3230:x=&CB10:GOSUB 3230:x=&1711:GOSUB 3230:x=&6AED:GOSUB 3230
:x=&52ED
4840 GOSUB 3230:x=&130:GOSUB 3230:x=&3F19:GOSUB 3230:x=&F310:GOSUB 3230:
x=&11CB
4850 GOSUB 3230:x=&5717:GOSUB 3230:x=&F159:GOSUB 3230:x=&DC17:GOSUB 3230
4860 x=c+&60:GOSUB 3230:x=&DCEB:GOSUB 3230:x=c+&60:GOSUB 3230:POKE m,&C9
4870 m=c+&D0:x=&7EE1:GOSUB 3230:x=&CD23:GOSUB 3230:x=c+&140:GOSUB 3230

4880 x=&20B7:GOSUB 3230:x=&E9F8:GOSUB 3230
4890 m=c+&E0:x=&2F3E:GOSUB 3230:x=&EDB7:GOSUB 3230:x=&3C42:GOSUB 3230:x=
&FB30
4900 GOSUB 3230:x=&FE09:GOSUB 3230:x=&2030:GOSUB 3230:x=&1502:GOSUB 3230
:x=&CDC0
4910 GOSUB 3230:x=c+&140:GOSUB 3230:x=&116:GOSUB 3230:POKE m,&C9
4920 m=c+&F8:x=&7CC8:GOSUB 3230:x=&828:GOSUB 3230:x=&CD:GOSUB 3200:x=c+&
58

4930 GOSUB 3230:x=&2D3E:GOSUB 3230:x=&CD:GOSUB 3200:x=c+&140:GOSUB 3230:
x=&16:GOSUB 3200:x=&100
4940 GOSUB 3230:x=&2710:GOSUB 3230:x=&CD:GOSUB 3200:x=c+&E0:GOSUB 3230:x
=&EB01
4950 GOSUB 3230:x=&CD03:GOSUB 3230:x=c+&E0:GOSUB 3230:x=&6401:GOSUB 3230
4960 x=&CD00:GOSUB 3230:x=c+&E0:GOSUB 3230:x=&A01:GOSUB 3230:x=&CD00
4970 GOSUB 3230:x=c+&E0:GOSUB 3230:x=&101:GOSUB 3230:x=&1600:GOSUB 3230:
x=&CD01
4980 GOSUB 3230:x=c+&E0:GOSUB 3230:x=&203E:GOSUB 3230
4990 x=&CD:GOSUB 3200:x=c+&140:GOSUB 3230:POKE m,&C9
5000 m=c+&130:x=&D3E:GOSUB 3230:x=&CD:GOSUB 3200:x=c+&140:GOSUB 3230:x=&
3E:GOSUB 3200
5010 x=&CD0A:GOSUB 3230:x=c+&140:GOSUB 3230:POKE m,&C9
5020 m=c+&140:x=&1E:GOSUB 3230:x=&1BCB:GOSUB 3230:x=&5AD2:GOSUB 3230:x=&
F5BB
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```
5030 GOSUB 3230:x=&2BCD:GOSUB 3230:x=&F1BD:GOSUB 3230:POKE m,&C9
5040 m=c+&1C0:x=&9CD:GOSUB 3230:x=&38BB:GOSUB 3230:x=&2105:GOSUB 3230:x=
&FFFF

5050 GOSUB 3230:x=&318:GOSUB 3230:x=&266F:GOSUB 3230:x=&C900:GOSUB 3230
5060 m=c+&1D0:POKE m,&21:m=m+1:x=c+&1F8:GOSUB 3230:x=&618:GOSUB 3230
5070 m=c+&1DB:POKE m,&21:m=m+1:x=c+&1FB:GOSUB 3230:POKE m,&11:m=m+1:x=c+
&208


5080 GOSUB 3230:x=&901:GOSUB 3230:x=&ED00:GOSUB 3230:x=&C9B0:GOSUB 3230
5090 m=c+&1E8:FOR k=m TO m+8:POKE k,0:NEXT:m=c+&1EE:x=&1404:GOSUB 3230
5100 m=c+&1F8:FOR k=m TO m+8:POKE k,0:NEXT:m=c+&1FE:x=&140C:GOSUB 3230
5110 m=c+&220:RETURN
5120 '
5130 ' Initialize
5140 MODE 2:BORDER 13:INK 1,0:INK 0,13
5150 PRINT"Amstrad BASIC Compiler  V1.0"
5160 PRINT"============================"
5170 a=&170:n=256*PEEK(a+1)+PEEK(a):l=256*PEEK(a+3)+PEEK(a+2)
5180 IF n<0 OR l>=1000 THEN PRINT:PRINT"NO PROGRAM IN MEMORY!":GOTO 5640
5190 c=HIMEM-FRE("")+8000:IF c>(HIMEM-1000) THEN ee=9:GOTO 5430: 'Error
5200 pp=c-4000:p=pp:w=pp+500:u=pp+600:s=pp+700:)=pp+1000
5210 FOR i=w TO c+&30:POKE i,0:NEXT
5220 RETURN


5230 '
5240 'Terminate
5250 IF u<>pp+600 THEN PRINT:PRINT"ERROR: FOR without NEXT":GOTO 5640
5260 IF w<>pp+500 THEN PRINT:PRINT"ERROR: WHILE without WEND":GOTO 5640
5270 PRINT:PRINT"Setting Jumps..."
5280 FOR i=c+&220 TO m-1
5290   b=PEEK(i):IF b<>&C3 AND b<>&CD THEN 5340
5300   l=256*PEEK(i+2)+PEEK(i+1):IF l<1 OR l>999 THEN 5340
5310   x=2*l+j:t=256*PEEK(x+1)+PEEK(x)
5320   IF t<(c+&220) OR t>=m THEN 5400
5330   POKE i+1,PEEK(x):POKE i+2,PEEK(x+1):i=i+2
5340 NEXT i
5350 PRINT:PRINT"Compilation completed.":PRINT
5360 PRINT" START:";HEX$(c),c
5370 PRINT"   END:";HEX$(m-1),m-1
5380 PRINT"LENGTH:";HEX$(m-c),m-c
5390 PRINT:RETURN
5400 PRINT:PRINT "ERROR: Line";l;"does not exist":GOTO 5640
5410 '


5420 'Error routine
5430 PRINT:PRINT "ERROR: ";
5440 IF ee=1 THEN PRINT"Illegal Command";
5450 IF ee=2 THEN PRINT"Too many or insufficient arguments";
5460 IF ee=3 THEN PRINT"Illegal variable";
5470 IF ee=4 THEN PRINT"Incomplete expression";
5480 IF ee=5 THEN PRINT"Syntax error";
5490 IF ee=6 THEN PRINT"Line number out of range";
5500 IF ee=7 THEN PRINT"Illegal function";
5510 IF ee=8 THEN PRINT"Number out of range";
5520 IF ee=9 THEN PRINT"OUT OF MEMORY!";
5530 IF ee=10 THEN PRINT"Command or variable expected";
5540 IF ee=11 THEN PRINT"= expected";
5550 IF ee=12 THEN PRINT"Variable expected";
5560 IF ee=13 THEN PRINT"Number expected";
5570 IF ee=14 THEN PRINT"Illegal operator";
5580 IF ee=15 THEN PRINT"TO expected";
5590 IF ee=16 THEN PRINT"THEN expected";
5600 IF ee=17 THEN PRINT"NEXT without FOR";
5610 IF ee=18 THEN PRINT"WEND without WHILE";
5620 IF ee<1 OR ee>18 THEN PRINT"Unknown error";
5630 PRINT" in line";l
5640 PRINT:PRINT"COMPILATION ABORTED":PRINT
5650 END
```

MICROTEX 666

This program is available electronically through Microtex 666's software downloading service. It is accessed through Viatel page *66637#.

BBC Function Key Fonts

by John Campbell

This program has been tested on a standard BBC B with DFS version 1.2. It has also been run, but not thoroughly checked, on an Electron. The program produces bold, italic, underline, super and subscripts, block, thin, narrow, wide, and inverse video fonts. These may all be combined, except for block, thin and narrow.

The fonts can be switched on and off by using a function key together with Shift or Ctrl, or by VDU codes 128 to 148. The unshifted function keys can thus be used for whatever other program is running. All effects can be cancelled by Shift–Ctrl–f0. User-defined characters, apart from 158 and 159, may be used in conjunction with the program. Instead of characters 128 to 148, which switch fonts, use 160 to 180.

When run, the program produces two pages of machine code and performs a checksum to test for errors in entry. The program then performs a demonstration of each of the fonts and asks whether you want to save the machine code, to which you should answer yes, and whether you want to print a keystrip. The saved machine code can then be used by *RUNning FONTS, or just *FONTS for disk users.

The Break key is set up to perform an Old command, and then resets the function key fonts.

The program intercepts the OSWRCH call which would normally write a character to screen, and copies the character into the space for character 158; this is then altered to produce the desired effect. Teletext graphics and colours operate normally, as the program does not work in mode seven. The machine code fits between &900 and &B00, and is used by the cassette filing system and the RS423 as the program has been written for disk systems with a parallel printer. Cassette users will have to reload the program after using the cassette or a serial printer; alternatively, the code could be relocated. Disk users with serial printers should relocate the code to &1600.

Note that printing when in modes other than seven will only work if the fonts are turned off by VDU 148. Similarly, cursor screen editing will only work in mode seven or if all the fonts are turned off.

Changes required for the Electron and for the BBC+/128/Master series are given after the program.

```
LIST
  100REM FUNCTION KEY FONTS SOURCE
  110REM Save as FONTS1
  120REM Produces code "FONTS" to *RUN
  130REM (c) John Campbell
  140
  150MODE 5
  160osword=&FFF1:osbyte=&FFF4:oscli=&FFF7
  170F$="Function Key Fonts"
  180PRINT''F$;
  190DIM font$(10)
```

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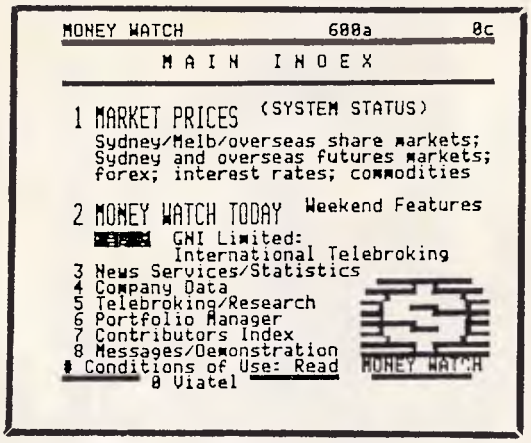

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```
  200
  210oswrchtarget=(!&20E)AND&FFFF
  220IF oswrchtarget<&8000 oswrchtarget=O% ELSE O%=oswrchtarget
  230REM Checks if altered already
  240REM Ensure source program can run twice!
  250?&20E=oswrchtarget MOD 256
  260?&20F=oswrchtarget DIV 256
  270
  280start=&900:REM Can alter to assemble elsewhere (eg &1600) -- alter
line 2360 also
  290code=&CF8
  300
  310FOR pass=0 TO 2 STEP2
  320P%=start
  330[OPT pass
  340\ Alter OSWRCH vector
  350LDA#(doit DIV 256):STA &20F
  360LDA#(doit MOD 256):STA &20E
  370
  380\ Setup CTRL/SHIFT + Fn keys
  390\ or FUNC+Letter keys (Electron)
  400LDA #226:LDX #128:JSR setkeys
  410LDA #227:LDX #138:JSR setkeys:LDA #228:LDX #148:JSR setkeys\ *** BB
C only
  420
  430\ Setup BREAK key
  440LDX #code_end MOD 256
  450LDY #code_end DIV 256
  460JSR oscli
  470
  480.clear LDA #1:LDY #9:.clr STA Font0,Y:DEY:BPL clr
  490RTS
  500
  510.setkeys LDY #0:JMP osbyte \ and return
  520
  530\ Flags for fonts
  540.Font0
  550.ItalicFont NOP
  560.BoldFont NOP
  570.UnderlineFont NOP
  580.BlockFont NOP
  590.ThinFont NOP
  600.NarrowFont NOP
  610.SuperFont NOP
  620.SubscriptFont NOP
  630.WideFont NOP
  640.InverseFont NOP
  650.scratch NOP
  660
  670.delete LDY WideFont:BNE exit:JSR oswrchtarget
  680
  690\ Exit if Fonts not required
  700.exit LDA code-1:JMP output
  710
  720\ Action here
  730\ Save registers
  740.doit:PHA:STA code-1:TYA:PHA:TXA:PHA
  750\ Check for MODE 7
  760LDA &355 \ what mode?
  770AND#7:CMP #7:BEQ exit \ allows for shadow mode
  780
  790\ Test VDU queue
  800LDX #0:LDY #255:LDA #218:JSR osbyte:TXA:BNE exit
  810
  820\ Test character values
  830LDA code-1
  840CMP #32:BCC exit       \ control code
  850CMP #127:BEQ delete    \ delete
  860BCC isiton             \ standard character
  870CMP #148:BCC fontcode \ font controlcode
  880BNE isiton          \ user-defined character
  890\ Must be greater than 148, (158 & 159 won't work)
  900JSR clear           \ 148 clears all fonts
  910
  920\ Set the font flags (ON=0)
  930.fontcode
  940LSR A:TAY:LDA #0:ROL A:STA Font0-64,Y:JMP clearup
  950
  960\ Printable character -- test all flags
  970.isiton
  980LDY #9:TYA:.isit AND Font0,Y:DEY:BPL isit:TAY:BNE exit
  990.FontON
 1000
 1010\ Transfer character to CHR$159
 1020.char:LDX #&F7:LDY #&C:LDA #&A:JSR osword
 1030
 1040\ Modify CHR$159 as needed
 1050
 1060LDY#7
 1070.nextY LDA code,Y
 1080
 1090\ Is it block
 1100LDX BlockFont:BNE NotBlock
 1110LSR A:TAX:AND #&F0:ORA code,Y:STA scratch:TXA:ORA #&F0:AND scratch
 1120JMP NotThese \ Block, Thin, Narrow fonts incompatible
 1130.NotBlock
 1140
 1150\ Is it thin
 1160LDX ThinFont:BNE NotThin
 1170ASL A:AND code,Y
 1180JMP NotThese
 1190.NotThin
 1200
 1210\ Is it narrow
 1220LDX NarrowFont:BNE NotNarrow
 1230ASL A:ORA #&F8:AND code,Y:STA scratch:LSR A:ORA #&F:AND scratch
 1240
 1250.NotNarrow
 1260.NotThese
 1270
 1280\ Is it bold
 1290LDX BoldFont:BNE NotBold
 1300LSR A:ORA code,Y
 1310.NotBold
 1320
 1330STA code,Y:DEY:BPL nextY
 1340
 1350\ Is it italic
 1360LDX ItalicFont:BNE NotItalic
 1370LSR code:LSR code+1:LDX #3
 1380.shift ASL code+4,X:DEX:BPL shift
 1390.NotItalic
 1400
 1410\ Is it super or sub
 1420LDA SuperFont:AND SubscriptFont:BNE NotScript
 1430TAX:TAY \ both =0
 1440LDA code:ORA code+1:STA code
 1450.comp LDA code+2,Y:STA code+1,Y
 1460INY:CPY #3:BNE comp
 1470LDA code+5:ORA code+6:STA code+4
 1480LDA code+7:STA code+5
 1490STX code+6:STX code+7
 1500
 1510\ Is it sub
 1520LDA SubscriptFont:BNE NotSubscript
 1530LDY #5:.sub LDA code,Y:STA code+2,Y:DEY:BPL sub
 1540STX code:STX code+1
 1550.NotSubscript
 1560.NotScript
 1570
 1580\ Is it underline
 1590LDX UnderlineFont:BNE NotUnderline
 1600LDA code+7
 1610ASL A:STA scratch:ROR A:LSR A:ORA scratch:EOR code+7:EOR #255
 1620STA code+7
 1630.NotUnderline
 1640
 1650\ Is it inverse
 1660LDA InverseFont:BNE NotInverse
 1670LDY #7:.inv LDA #255:EOR code,Y:STA code,Y:DEY:BPL inv
```

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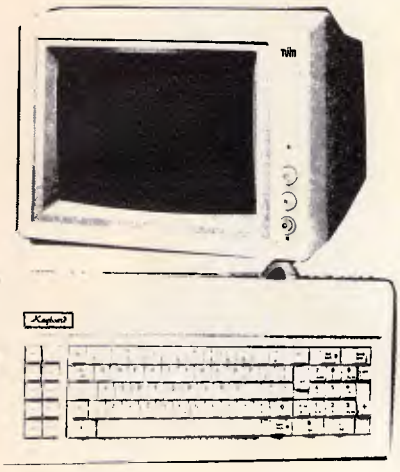

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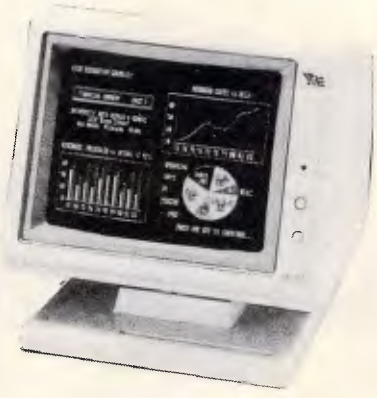

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```
1680.NotInverse
1690
1700\ Is it wide
1710LDA WideFont:BNE NotWide
1720JSR double:JSR double:JMP clearup
1730
1740.double LDX #7
1750.nextline LDA code,X:LDY #3
1760.nextbit ASL A:ASL A:ASL code,X
1770BCC test:ORA #3
1780.test DEY:BPL nextbit
1790STA code-8,X
1800DEX:BPL nextline
1810\ Output half a character
1820LDA #&9E:JMP oswrchtarget
1830.NotWide
1840
1850\ Now output modified character
1860LDA#&9F
1870.output JSR oswrchtarget
1880.clearup PLA:TAX:PLA:TAY:PLA:RTS
1890.code_end
1900]
1910
1920@%=&90A
1930REM Do NOT omit the REM in the next line!
1940$code_end = "K.100.|K|MCA."+STR$(start)+":REM"+STRING$(12,"|H")+"Fu
nction Key Fonts|J|M"
1950end=code_end + LEN($code_end)
1960
1970NEXT pass
1980
1990J%=0:FORI=start TO end:J%=J%+?I:NEXTI
2000IF J%<>55400 PRINT'"Checksum error":END
2010CALL start
2020
2030REM Main program is finished
2040REM Part2 is demonstration etc.
2050
2060MODE6
2070
2080FOR I=0 TO 10:READ font$(I):NEXT I
2090DATA Italics,Bold,Underline,Block,Thin,Narrow,Superscript,Subscript
,Wide,Inverse,Normal
2100abc$=FNadd(126):half$=FNadd(77)
2110
2120VDU144:PRINT'F$:VDU145
2130VDU134:PRINT'"Ten extra fonts are available:":VDU135
2140PRINT'"H"CHR$142"ERE THEY ARE -"':VDU148
2150FOR I=0TO9
2160ch=128+2*I:PRINT TAB((I*15)MOD45)CHR$ch;font$(I);CHR$148;
2170NEXT I
2180PRINT TAB(15);:VDU134,140,132:PRINT"and COMBINATIONS":VDU148
2190PRINT TAB(0,23)CHR$136"Press spacebar to exit"CHR$137
2200
2210I=0
2220REPEAT
2230ch=128+2*I
2240PRINT TAB(0,13)SPC(14);TAB(0,13)CHR$(ch);font$(1);" -"CHR$148
2250PRINT'"Turn on by ";FNK(2*I);" or VDU";ch;SPC(18)
2260IF I<>10 PRINT"and off by ";FNK(2*I+1);" or VDU";ch+1;" or VDU148 "
ELSE PRINTSPC(38)
2270PRINT TAB(0,18)CHR$(ch)
2280IF ch=144 PRINT half$ ELSE PRINT abc$
2290PRINT'
2300IF I<>10 VDU(ch+1)
2310I=(I+1)MOD11
2320UNTIL INKEY(100)=32
2330FOR I=0TO10:PRINT TAB(0,13+I)SPC(40);:NEXT
2340VDU134
2350PRINT TAB(0,16);
2355*DIR$
2356REM Above line for PCW demo prog only
2360IF FNyes("Save code") THEN *SAVE"FONTS" 900+200
2370VDU135,130
2380
2390PRINT'
2400IF FNyes("Print keystrip") PROCkeystrip
2410VDU131
2420PRINT'
2430END
2440
2450REM Error in printing
2460*FX3
2470REPORT
2480END
2490
2500DEF FNyes(A$)
2510LOCAL Y%
2520PRINT A$" (Y/N):";
2530*FX15 1
2540REPEAT
2550Y%=GET AND &5F:REM Force upper case
2560UNTIL Y%=78 OR Y%=89
2570VDU Y%
2580IF Y%=89:=TRUE ELSE=FALSE
2590
2600DEF FNinv(A$)=CHR$146+A$+CHR$147
2610DEF FNblock(A$)=CHR$142+FNinv(A$)+CHR$143
2620
2630DEF FNadd(J)
2640LOCAL A$,I
2650FOR I=33 TO J
2660A$=A$+CHR$I
2670NEXT
2680=A$+" "+FNgreek
2690
2700DEF FNgreek
2710VDU23,160,126,48,24,12,24,48,126,0:REM sigma
2720VDU23,161,0,0,102,102,102,124,64,192:REM mu
2730VDU23,162,56,10B,12,12,28,54,102,0:REM lambda
2740=CHR$160+CHR$161+CHR$162
2750
2760REM ************************************************
2770REM *** The following section is for all BBC models ***
2780REM ************************************************
2790
2800DEF FNK(J):LOCAL K$:REM BBC only
2810IF J<10 OR J=20 K$=FNblock("SHIFT")+"+"
2820IF J>9 K$=K$+FNblock("CTRL")+"+"
2830=K$+FNf(J MOD10)
2840
2850DEF FNf(A%)=FNinv("f")+FNblock(STR$A%)
2860
2870DEFPROCkeystrip
2880VDU148
2890ONERRORGOTO2460
2900*FX3 10
2910VDU27,64,15,27,48,27,85,1,27,71,1
2920REM Codes for Epson compatible printers
2930PRINTSTRING$(132,"-")
2940PRINT"CTRL+";:PROCfkey(0,"Normal ON"):PROCrest(1)
2950PRINT"SHIFT";:PROCfkey(0,"All OFF-148"):PROCrest(1)
2960PROCrest(0)
2970PRINT"CTRL";:FOR I=0TO9:PROCfkey(I,font$(1 DIV 2 +5)):NEXT:PRINT
2980FOR I=0TO9STEP2:PROCfkey(I,"ON--"+STR$(138+I)):PROCfkey(I+1,"OFF--"
+STR$(139+I)):NEXT.PRINT
2990PROCrest(0)
3000PRINT"SHIFT";:FOR I=0TO9:PROCfkey(1,font$(1 DIV 2)):NEXT:PRINT
3010FOR I=0TO9STEP2:PROCfkey(I,"ON--"+STR$(128+I)):PROCfkey(I+1,"OFF--"
+STR$(129+I)):NEXT:PRINT
3020PRINTSTRING$(132,"-")
3030VDU27,64
3040*FX3
3050ENDPROC
3060
3070DEFPROCfkey(I,A$)
3080LOCAL A%
3090A%=6-LENA$/2:A$=STRING$(A%," ")+A$
3100PRINTTAB(I*12.8+6)"|"A$;
3110ENDPROC
```

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```
3120
3130DEFPROCrest(I)
3140LOCAL J
3150FOR J=I TO 9:PROCfkey(J,""):NEXT
3160PRINT
3170ENDPROC
```

Spectrum Globeplotter

by G Wearmouth

This program transposes any Spectrum screen onto the surface of a sphere and replots it at intervals shifted by a number of pixels. This produces the effect of spinning globe animation at a speed dependent on the radius of the sphere. The program installs various machine code routines, and produces a menu allowing the user to select parameters and load in source and background screens. The program can handle mercator or sinusoidal projections. With mercator projections, the material at the equator of the sphere will be enlarged and chunky, while material at the poles will be reduced. Sinusoidal projections retain detail to a greater extent.

The machine code plotting routines rely on a table produced by the Basic program which starts at location 64256 and grows upwards. For each line of the globe there are three addresses — six bytes in high-low order. The table is terminated by a zero end marker. The first address is of the cosine table to be used; the second is where plotting is to start; and the third is the left-hand location of the screen line to be used as data. Both the source and background screens are located above RAM-top.

The cosine table begins at 64255 and grows downward. There is a separation table for each line of a hemisphere. The same tables are used to plot both hemispheres and both right and left halves, so each cosine table is used four times and the number of tables needed will be equal to the radius.

The machine code can be disassembled at 3900. Interrupts are disabled to gain speed and to free the IY register. The HL' register is preserved on the machine stack. Register use is as follows:

HL — vector. H will hold either testing or plotting page.
DE — plotting address on background screen.
BC — cosine table.
A — pixel count.
A' — if H holds plot page, then point page is stored here, and *vice versa*.
HL' — point address on source screen.
DE' — constants to speed up comparison.
BC' — unused.
IX — return address from POINT routine, constant.
IY — return address from PLOT routine, constant.

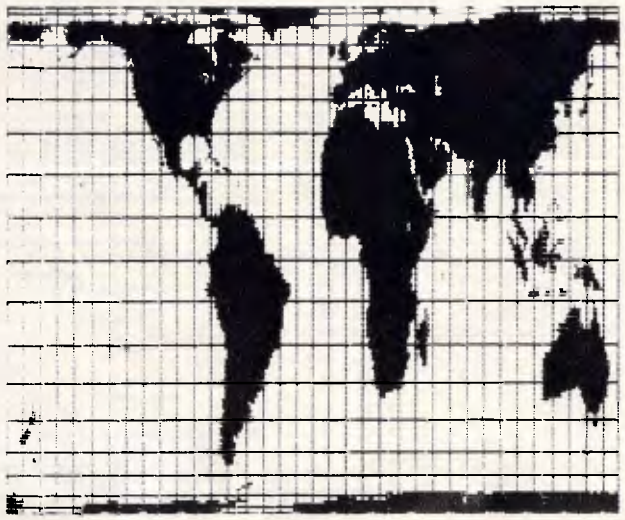
Save the program before testing. Before running or saving, GOTO 9900 will checksum the data.

When the program is running, if you type GOTO 9999 to save everything above RAM-top, then this block of code will work independently. If using a tape recorder, change line 6550 to 6550 LOAD t$ SCREEN$.

```
  10 REM
  20 REM     Globeplotter.
  30 REM
  40 REM Geoffrey Wearmouth.
  50 REM       1986.
  60 REM
  70 REM
  80 CLEAR 38999
  85 REM  IF PEEK 39000<>58 THEN  LOAD "example"CODE : RANDOMIZE USR 39000
  90 IF PEEK 39000<>58 THEN  GO SUB 9000: REM install m-code.
 100 REM     MENU
 110 REM
 120 BORDER 7: CLS
 130 PRINT AT 1,12;"OPTIONS"
 140 PRINT : PRINT
 150 PRINT " 1)-- View."
 160 PRINT
 170 PRINT " 2)-- Alter radius"
 180 PRINT
 190 PRINT " 3)-- Vary speed."
 200 PRINT
 210 PRINT " 4)-- Change border"
 220 PRINT
 230 PRINT " 5)-- Load scource screen. *"
 240 PRINT
 250 PRINT " 6)-- Load backdrop screen. *"
 260 PRINT : PRINT
 270 PRINT "* ""default"" may be used."
 280 PRINT
 290 PRINT "Controls -"
 300 PRINT "Q-Quit  P-Printout"
 310 FOR i=0 TO 2: PRINT AT 6+i*2,26;"(";PEEK (39418+i);")  ": NEXT i: REM print
 current values
 500 REM get keypress
 510 REM
 520 LET a=CODE INKEY$-48
 530 IF a<1 THEN  GO TO 500
 540 IF a>6 THEN  GO TO 500
 550 GO SUB a*1000
 560 GO TO 100
1000 REM      VIEW.
1010 REM
1020 IF NOT PEEK 39418 THEN  PRINT )0;"Data absent - Use 2": PAUSE 0: RETURN
1030 RANDOMIZE USR 39000
1040 RETURN
2000 REM INSTALL LOOK-UP TABLES
2010 REM    FDR NEW RADIUS.
2020 REM
2030 REM
2040 INPUT "Radius (10-96) ";r
2050 IF r<10 THEN  GO TO 2040
2060 IF r>96 THEN  GO TO 2040
2070 POKE 39418,r
2080 INPUT " Mercator/Sinusoidal (m or s)?  ";m$
2090 PRINT )0;"Walt ";r/6;"mins"
2100 BORDER 4
2110 LET a=64255: REM grows down
2120 DIM c(192,3)
2130   FOR i=1 TO r
2140   LET sr=SQR (r^2-i^2)
2150   IF NOT sr THEN  LET sr=1
2160   DIM b(sr+1)
2170    FOR j=1 TO 64
2180    LET angle=PI/2*j/64
2190    LET x=COS angle*sr
2200    LET x=x+1
2210    LET b(x)=b(x)+1
2220    NEXT j
2230   LET c(97-i,1)=a
2240   LET c(96+i,1)=a
2250    FOR j=1 TO sr+I
2260    LET b(j)=b(j)*2
2270    IF b(j)=0 THEN  LET b(j)=I
2280    POKE a,b(j): LET a=a-1
2290    NEXT j
2300   POKE a,255: LET a=a-1
2310   NEXT i
2400 REM Set up table of screen
2410 REM  addresses.
2420 REM
2430 LET p=I
2440   FOR i=0 TO 2
2450    FOR j=0 TO 7
2460     FOR k=0 TO 7
```

```
2470     LET c(p,2)=16384+i*2048          +j*32+k*256
2480     LET p=p+1
2490     NEXT k
2500    NEXT j
2510   NEXT i
2600 REM Set up scource address.
2610 REM ═══════════════════════
2620   FOR i=1 TO r
2630   LET angle=ASN (i/r)
2640   LET y=angle*2/PI*87
2650   IF CODE m$=115 THEN  LET          y=i/r*87
2660   LET c(97-i,3)=c(89-y,2)
2670   LET c(96+i,3)=c(88+y,2)
2680   NEXT i
2700 REM Add offsets
2710 REM ═══════════════
2720   FOR i=1 TO 192
2730   LET c(i,2)=c(i,2)+33292
2740   LET c(i,3)=c(i,3)+27136
2750   NEXT i
2800 REM Install address table.
2810 REM ═══════════════════════
2820 LET a=64256: REM grows up
2840   FOR i=1 TO 192
2850   IF NOT c(i,1) THEN  GO TO         2920
2860    FOR j=1 TO 3
2870    LET h=INT (c(i,j)/256)
2880    LET l=c(i,j)-h*256
2890    POKE a,h: LET a=a+1
2900    POKE a,l: LET a=a+1
2910    NEXT j
2920   NEXT i
2930 POKE a,0: REM end marker.
2940 RETURN
3000 REM     SPEED
3010 REM ═══════════
3020 INPUT " Speed (1-255) ";s
3030 IF s<1 THEN  GO TO 3020
3040 IF s>255 THEN  GO TO 3020
3050 POKE 39419,s: RETURN
4000 REM      BORDER
4010 REM ═══════════
4020 INPUT " Border (0-7)",b
4030 IF b<0 THEN  GO TO 4020
4040 IF b>7 THEN  GO TO 4020
4050 POKE 39420,b: RETURN
5000 REM  SCOURCE SCREEN
5010 REM ═══════════════
5020 GO SUB 6500
5030 IF d THEN  GO SUB 5500
5040 RANDOMIZE USR 39205
5050 RETURN
5500 REM default scource
5510 CLS : FOR i=1 TO 704: PRINT ;CHR$ (128+RND*15);: NEXT i: PRINT AT 11,0;"PRE
SS Q TO QUIT": RETURN
6000 REM  BACKDROP.
6010 REM ═══════════
6020 GO SUB 6500
6030 IF d THEN  RANDOMIZE USR 39220: BEEP .1,1: RETURN
6040 RANDOMIZE USR 39260
6050 RETURN
6500 REM title input
6501 REM ═══════════
6510 LET d=0
6520 INPUT "Title ";t$
6530 IF LEN t$>10 THEN  GO TO 6520
6540 IF t$="default" THEN  LET d=1: RETURN
6550 LOAD t$SCREEN$
6560 RETURN
9000 REM  MACHINE CODE.
9010 REM ═══════════════
9015 PRINT "Initialisation"
9020 POKE 39418,0: REM radius
9030 POKE 39419,2: REM speed
9040 POKE 39420,1: REM border
9050 REM 32 Plot Routines
9060 REM ═══════════════
9070   FOR i=41472 TO 43456 STEP 64
9080   LET a=i
9090   IF i<43264 THEN  POKE a,36:       LET a=a+1: GO TO 9110
9100   POKE a,38: POKE a+1,162:          LET a=a+2
9110   POKE a,235: LET a=a+1
9120   IF i=41536 OR i=41664             THEN  POKE a,44: LET a=a+1
9130   POKE a,203: LET a=a+1
9140   READ b: POKE a,ABS b: LET        a=a+1: IF b<0 THEN  GO TO        9140
9150   POKE a,235: POKE a+1,253:         POKE a+2,233
9160   NEXT i
9170 DATA 134,190,198,254,142,182,206,246,150,174,214,238,158,166,222,230,166,15
8,230,222,174,150,238,214,182,142,246,206,-190,45,134,-254,45,198
9200 REM 32 Point Routines.
9210 REM ═══════════════════
9220   FOR i=39424 TO 41408 STEP 64
9230   POKE i,36: POKE i+1,221:          POKE i+2,233
9240   NEXT i
9250   FOR i=1 TO 10: READ b
9260    FOR j=39424 TO 41408 STEP        256
9270    POKE i+j,b: POKE i+j+64,         b+(b=128)*64
9280    NEXT j
9290   NEXT i
9300 DATA 217,203,70,217,40,2,46,128,221,233
9310   FOR i=39424 TO 41216 STEP         256
9320   READ b: POKE i+3,b
9330   READ b: POKE i+67,b
9340   NEXT i
9350 DATA 70,0,78,70,86,78,94,86,102,94,110,102,118,110,0,118
9360   FOR i=39488 TO 41408 STEP         128
9370   POKE i,37
9380   NEXT i
9400 REM loader
9410 REM ═══════
9420 READ b: IF b>255 THEN  LET a=b: GO TO 9420
9430 IF b<0 THEN  RETURN
9440 POKE a,b: LET a=a+1
9450 GO TO 9420
9500 REM Main Routine.
9510 REM ═════════════
9520 DATA 39000
9530 DATA 58,252,153,230,7,211,254,58,0,218,167,40,11,33,0,194
9540 DATA 17,0,64,1,0,27,237,176,243,221,33,252,152,253,33,240
9550 DATA 152,217,229,22,31,30,32,217,205,23,153,62,251,219,254,31
9555 DATA 56,8,253,33,58,92,225,217,251,201,62,223,219,254,31,56
9560 DATA 14,253,33,58,92,6,192,205,175,14,243,253,33,240,152,58
9570 DATA 255,153,33,251,153,150,245,50,255,153,230,7,238,7,198,154
9580 DATA 50,253,153,241,203,63,203,63,203,63,50,254,153,33,0,251
9590 DATA 229,225,126,254,0,40,177,71,35,78,35,86,35,94,35,126
9600 DATA 35,8,58,254,153,182,35,229,217,111,8,103,229,217,213,197
9610 DATA 46,0,58,253,153,8,38,162,124,8,103,10,11,203,63,56
9620 DATA 10,203,189,233,61,32,252,124,8,103,233,32,4,124,8,103
9630 DATA 233,203,117,194,201,152,193,209,217,225,217,203,245,24,211,0
9640 DATA 33,0,194,17,0,64,1,0,24,237,176,201
9650 REM store scource.
9660 DATA 39205
9670 DATA 33,0,64,17,0,170,1,0,24,237,176,201
9680 REM store backdrop.
9690 DATA 39260
9700 DATA 33,0,64,17,0,194,1,0,27,237,176,201
9710 REM default backdrop.
9720 DATA 39220
9730 DATA 33,0,194,17,1,194,1,0,24,54,85,237,176,1,255,2,54,14,237,176,62,1,50,2
52,153,201
9740 REM 4 point routines.
9750 DATA 39488
9760 DATA 38,161,217,245,44,125,162,40,10,241,203,126,217,40,2,46,192,221,233,12
5,147,111,241,203,126,217,40,2,46,192,221,233
9770 DATA 39616
9780 DATA 38,161,217,245,44,125,162,40,4,241,217,221,233,125,147,111,241,217,221
,233
9790 DATA 41216
9800 DATA 38,154,217,203,126,245,45,125,162,170,40,8,241,217,40,2,46,128,221,233
,125,198,32,111,241,217,40,2,46,128,221,233
9810 DATA 41344
9820 DATA 38,154,217,245,45,125,162,170,40,4,241,217,221,233,125,131,111,241,217
,221,233
9830 DATA -999
9900 REM checksum
9910 RESTORE : LET s=0
9920 FOR i=1 TO 412: READ b: LET s=s+b: NEXT i
9930 PRINT "Checksum is ";s
9940 PRINT "Should be   369277"
9998 STOP
9999 SAVE "example"CODE 39000,26536
```

Example output from Spectrum Globeplotter



Amstrad CPC464 Fill Subroutine

by Rudi Way

This fill subroutine will fill any shape, including ones with holes and dangling lines. It can fill with any colour, and will work on shapes with multi-coloured outlines. It also works in all three screen modes with only minor modification.

It works by looking for the largest block in the shape. While filling it, it detects spaces around this block which need to be filled, and pushes these onto a stack.

When the block is filled, the stack is popped and the next block is filled, following the same process. This continues until the stack is empty.

To use the utility, enter seed coordinates (starting point to fill from) as xseed% and yseed%, background colour as bacol%, and fill colour as incol%, and then GOSUB the line where the subroutine starts.

The program consists of three parts. The first is an example of filling a shape with a multi-coloured outline; the second is a routine to generate random shapes and fill them — this part can be stopped by pressing ESC twice; and the third part is the routine itself (2.5k long).

```
10 ' ########################################
20 ' #                                      #
30 ' #      FILL SUBROUTINE for CPC 464     #
40 ' #                                      #
50 ' #             by Ruud Way              #
60 ' #                                      #
70 ' ########################################
```

```
80 '
90 '-----------------------------------------
100 '    PROGRAM DRAWS CONE + RANDOM SHAPES
110 '-----------------------------------------
120 RANDOMIZE TIME
130 MODE 1
140 INK 0,26:INK 1,13:INK 2,2:INK 3,1
150 BORDER 26:CLG 0
160 PAPER 0:PEN 1
170 ORIGIN 320,130
180 '
190 'shadows
200 MOVE 160,60:DRAW 26,-14,1
210 MOVE 160,60:DRAW 34,28,1
220 MOVE 26,-14:DRAW 2,148,3
230 '
240 'half ellipse
250 ellip=2:n%=24:r%=20
260 s=SIN(-PI/n%)
270 c=COS(-PI/n%)
280 odx=r%
290 ody=0
300 MOVE ellip*r%,0
310 FOR t%=1 TO n%
320   dx=odx*c-ody*s
330   dy=ody*c+odx*s
340   odx=dx
350   ody=dy
360   IF t%<=7 THEN col%=3 ELSE col%=2
370   DRAW ellip*dx,dy,col%
380 NEXT t%
390 '
400 'cone
410 DRAW 0,150,2
420 MOVE 2,150:DRAW ellip*r%,0,3
430 '
440 'fill in cone and shadows
450 bacol%=0
460 incol%=2:xseed%=-38:yseed%=0  :GOSUB 1080
470 incol%=3:xseed%=38 :yseed%=0  :GOSUB 1080
480 incol%=3:xseed%=6  :yseed%=128:GOSUB 1080
490 incol%=1:xseed%=36 :yseed%=26 :GOSUB 1080
500 '
510 WHILE INKEY$<>"":WEND
520 LOCATE 1,25:PRINT"press any key to continue";
530 WHILE INKEY$="":WEND
540 '
550 '
560 'next frame
570 CLG 0
580 INK 0,0:INK 1,26:INK 2,6:INK 3,2
590 ORIGIN 245,125
600 BORDER 0
610 '
620 'box
630 w%=150
640 MOVE 0,0
650 DRAW w%,0,1
660 DRAW w%,w%,1
670 DRAW 0,w%,1
680 DRAW 0,0,1
690 '
700 'random outlines
710 MOVE 10,10
720 FOR i%=1 TO 10
730   DRAW w%*RND,w%*RND,1
740 NEXT i%
750 DRAW 10,10,1
760 '
770 'fill in random generated shape
780 xseed%=w%\2:yseed%=w%\2
790 incol%=2:bacol%=0
800 GOSUB 1080
810 '
820 'fill box, if possible
830 incol%=3:bacol%=0
840 xseed%=w%-2:yseed%=2    :GOSUB 1080
850 xseed%=w%-2:yseed%=w%-2:GOSUB 1080
860 xseed%=2    :yseed%=2   :GOSUB 1080
870 xseed%=2    :yseed%=w%-2:GOSUB 1080
880 '
890 t=TIME
900 WHILE TIME-t<300:WEND
910 CLG 0:GOTO 640
920 'end of program
930 '
940 '-----------------------------------------
950 '              FILL SUBROUTINE
960 '-----------------------------------------
970 'enter: seedcoordinates   xseed%,yseed%
980 '       backgroundcolour  bacol%
990 '       fillcolour        incol%
1000 '
1010 'real variables regain their value after returning from FILL
1020 '
1030 'changes for mode 0 & 2:
1040 'mode 2: left=1, all x-stepvalues=1
1050 '( for instance line 1140: x2=x2+1 )
1060 'mode 0: left=4, all x-stepvalues=4
1070 '
1080 DEFINT a-z
1090 DIM stack(1,100)
1100 ptr=0
1110 hole=0
1120 '
1130 x2=xseed%
1140 WHILE TEST(x2,yseed%)=bacol%:x2=x2+2:WEND
1150 '
1160 x1=xseed%
1170 IF TEST(x1,yseed%)=bacol% THEN WHILE TEST(x1-2,yseed%)=bacol%:x1=x1-2:WEND
1180 '
1190 y1.old=yseed%
1200 y2.old=yseed%
1210 '
1220 FOR x=x1 TO x2 STEP 2
1230 '
1240   y1=yseed%
1250   IF TEST(x,y1)=bacol% THEN WHILE TEST(x,y1-2)=bacol%:y1=y1-2:WEND
1260 '
1270   y2=yseed%
1280   IF TEST(x,y2)=bacol% THEN WHILE TEST(x,y2+2)=bacol%:y2=y2+2:WEND
1290 '
1300   IF x<x2 THEN MOVE x,y1:DRAW x,y2,incol%
1310 '
1320   IF ABS(y1-y1.old)<=2 AND y2-y1>2 AND x<>x1 THEN 1400 'ELSE
1330     IF y1.old>y1 THEN left=2:stp=2 ELSE left=0:stp=-2
1340     FOR y=y1 TO y1.old STEP stp
1350       tst=TEST(x-left,y)
1360       IF NOT hole AND tst=bacol% THEN hole=-1:ytemp=y
1370       IF hole AND tst<>bacol% THEN hole=0:stack(0,ptr)=x-left:
           stack(1,ptr)=(ytemp+y-stp)\2:ptr=ptr+1
1380     NEXT y
1390     IF hole THEN hole=0:stack(0,ptr)=x-left:
         stack(1,ptr)=(ytemp+y1.old)\2:ptr=ptr+1
1400 ' FI
1410 '
1420   IF ABS(y2-y2.old)<=2 AND y2-y1>2 AND x<>x1 THEN 1500 'ELSE
1430     IF y2.old<y2 THEN left=2:stp=-2 ELSE left=0:stp=2
1440     FOR y=y2 TO y2.old STEP stp
1450       tst=TEST(x-left,y)
1460       IF NOT hole AND tst=bacol% THEN hole=-1:ytemp=y
1470       IF hole AND tst<>bacol% THEN hole=0:stack(0,ptr)=x-left:
           stack(1,ptr)=(ytemp+y-stp)\2:ptr=ptr+1
1480     NEXT y
1490     IF hole THEN hole=0:stack(0,ptr)=x-left:
         stack(1,ptr)=(ytemp+y2.old)\2:ptr=ptr+1
1500 ' FI
1510 '
1520   y1.old=y1
1530   y2.old=y2
1540 '
1550 NEXT x
1560 '
1570 'pop stack and fill
1580 IF ptr<>0 THEN ptr=ptr-1:xseed%=stack(0,ptr):yseed%=stack(1,ptr):GOTO 1130
1590 '
1600 ERASE stack
1610 DEFREAL a-z
1620 RETURN
```

MBasic Logarithmic Plotting

by John Rait

The author of this routine uses it in his work as a consulting engineer, as a great deal of his work involves exponential and power relationships when calculating the flow of pulp suspensions through pipes. (Analysis of liquid flow in pipes is one of the hardest problems in applied mathematics.)

LOG-PLOT carries out the necessary calculations to scale and plot graphs, using logarithmic scales.

```
10      REM LOG-PLOT.BAS
15      REM MBASIC/BASIC-80 for CP/M Z80 CPU
20      REM By John M. Rait - May 1984.
25      REM
30      REM
100 WIDTH LPRINT 79      'OMIT WHEN RE-TYPING THE PROGRAM
110 DEFINT V-Z
120 DEFSTR A,E,I,O,U
200 GOSUB 10000
210 PRINT"LOGARITHMIC SCALE CALCULATIONS - J.M. Rait 840501"
220 PRINT:PRINT"This program calculates the plotting positions for the drawing
of logarithmic   graphs to any scale and between any values."
230 PRINT:PRINT"You require to know the chosen scale length in millimeters and
the maximum and  minimum values of the range to plot."
240 PRINT:INPUT"SCALE LENGTH IN MM.";CSL%
250 INPUT"MAXIMUM VALUE";MAX:INPUT"MINIMUM VALUE";MIN
255 IF MIN=0 THEN PRINT"YOU MAY NOT HAVE ZERO AS MINIMUM ":GOTO 250
260 TSL=CSL%/(100-(LOG(MIN)/LOG(MAX)*100))*100
270 PRINT"THEORETICAL SCALE LENGTH  " TSL
280 FACTOR=TSL/LOG(MAX):PRINT"FACTOR  " FACTOR*LOG(10)
290 CONSTANT=TSL-CSL%:PRINT"CONSTANT  " CONSTANT
300 PRINT:PRINT"NOTE THESE FIGURES FOR LATER REFERENCE."
310 PRINT "HIT ANY KEY TO GO ON":GOSUB 10100
320 GOSUB 10000:PRINT"CALCULATION ROUTINES.":PRINT
325 INPUT;"HIT <1> TO PLOT - <2> TO BACK CALCULATE - <3> TO QUIT";V:ON V GOTO
    330,400,9999
330 GOSUB 10000:PRINT"ENTER <0> TO QUIT":PRINT
335 INPUT;'PLOT VALUE";PV: IF PV=0 THEN GOTO 320
340 MM=LOG(PV)*FACTOR-CONSTANT
350 PRINT TAB(25) USING " SCALE PLOT POSITION   ###.###";MM:GOTO 335
400 GOSUB 10000:PRINT"BACK CALCULATION ROUTINE. <99999> TO QUIT":PRINT
410 INPUT;"SCALE PLOT POSITION";MM:IF MM=99999! THEN GOTO 320
420 PV=EXP((MM+CONSTANT)/FACTOR)
430 PRINT TAB(30) USING"PLOT VALUE   ######.####";PV
440 GOTO 410
9999 END
10000 PRINT CHR$(27);CHR$(69):RETURN                    'CLS SUBR.
10100 I=INKEY$:IF I="" THEN GOTO 10100 ELSE RETURN      'INKEY$ SUBR.
```

CP/M STAT Command Tip

by Thomas Hardy

The STAT command can be used to hide disk files from prying eyes. When you type in STAT *.* $SYS on CP/M systems, all disk files are completely hidden.

To see them again through the use of the DIR command, type STAT *.* $DIR.

Share Trader

by K Riordan

MICROTEX 666

This program is available electronically through Microtex 666's software downloading service. It is accessed through Viatel page *66637#.

Anyone wanting to plot the recent boom in share prices (or the predicted catastrophic crash) will find Kevin's latest work immensely useful. Full details and program description are in the listing.

```
1000 REM ************************************************************************
1001 REM **                                                                    **
1002 REM **                        "SHARE TRADER"                              **
1003 REM **                                                                    **
1004 REM **          A SHARE PRICE MOVEMENT HISTORY STORAGE                    **
1005 REM **            AND RETRIEVAL SYSTEM  WRITTEN FOR                       **
1006 REM **            COMMODORE 64 WITH 1541 DISK DRIVE                       **
1007 REM **                                                                    **
1008 REM **                    (KEVIN RIORDAN 1986)                            **
1009 REM **                                                                    **
1010 REM ************************************************************************
1011 :
1012 REM  'SHARE TRADER'  IS DESIGNED  TO ASSIST STOCK MARKET INVESTORS TO KEEP
1013 REM     TRACK OF THE PRICE MOVEMENTS  AND DAILY SALES VOLUMES OF UP TO 100
1014 REM     STOCKS FOR A 12-MONTH TRADING PERIOD.  IT CREATES TWO PRE-EXTENDED
1015 REM     FILES ON EVERY  DATA DISK  WHICH IT FORMATS ON USER DEMAND FOR ITS
1016 REM     OWN USE.    SINCE THE USER  MAY WISH TO  WRITE ROUTINES TO EXTRACT
1017 REM     STATISTICAL INFORMATION FROM HIS/HER DATA BASE, THE FOLLOWING IS A
1018 REM     DESCRIPTION OF EACH DATA FILE AND ITS RECORD STRUCTURE:
1019 :
1020 REM  THE FIRST FILE IS CALLED 'INDEX'.  AS ITS NAME SUGGESTS,  IT CONTAINS
1021 REM     A LEXICOGRAPHICALLY-ORDERED LIST OF STOCKS,  TOGETHER WITH LINKAGE
1022 REM     POINTERS.  THE RECORD LENGTH IS 20 CHARACTERS,  OF WHICH THE FIRST
1023 REM     16  COMPRISE  THE  NAME OF A STOCK  LEFT-JUSTIFIED  WITH  TRAILING
1024 REM     SPACES.    THE REMAINING 4 CHARACTERS COMPRISE A LINKAGE FIELD HELD
1025 REM     IN STANDARD  NUMERIC ASCII  FORMAT  RIGHT-JUSTIFIED  WITH  LEADING
1026 REM     SPACES.    THIS FIELD CONTAINS THE RECORD NUMBER OF THE FIRST ENTRY
1027 REM     FOR THIS STOCK IN THE 'HISTORY' FILE.
1028 :
1029 REM  THE INDEX ENTRY FOR THE  BHP $1 SHARE,  FOR EXAMPLE,  WOULD LOOK LIKE
1030 REM     THIS (USING '*' AND '@' TO DENOTE TRAILING AND LEADING SPACES):
1031 :
1032 REM     BHP $1**********@@27
1033 :
1034 REM  THIS INDICATES THAT THE  FIRST  ENTRY FOR THE   BHP $1  SHARE APPEARS
1035 REM     AT THE 27TH RECORD OF THE 'HISTORY' FILE.
1036 :
1037 REM  AS INFERRED,  THE SECOND FILE IS CALLED 'HISTORY'.    ITS RECORDS ARE
1038 REM     21 CHARACTERS LONG AND THE FIELD CONTENT IS AS FOLLOWS:
1039 :
1040 REM        CHARACTERS                          CONTENT
1041 :
1042 REM            1-3          TRADING DATE HELD IN  'YMD'  FORMAT WHICH MAY BE
1043 REM                         READ BY THE 'ASC' FUNCTION (SEE 2010-2014).
1044 REM            4-8          OPENING  TRADING  PRICE  EXPRESSED AS  $$.CC  IN
1045 REM                         NUMERIC ASCII FORMAT RIGHT-JUSTIFIED.
1046 REM            9-13         CLOSING  TRADING  PRICE  EXPRESSED AS  $$.CC  IN
1047 REM                         NUMERIC ASCII FORMAT RIGHT-JUSTIFIED.
1048 REM           14-17         VOLUME OF DAILY SALES IN 100S. THIS IS HELD AS A
1049 REM                         NUMERIC   ASCII   STRING   RIGHT-JUSTIFIED  WITH
1050 REM                         LEADING SPACES.
1051 REM           18-21          LINK FIELD CONTAINING  A FORWARD POINTER TO THIS
1052 REM                         STOCK'S NEXT ENTRY IN THE 'HISTORY' FILE.
1053 :
1054 REM  THE DATA LINES BELOW CONTAIN MACHINE CODE ROUTINES TO FACILITATE DISK
1055 REM     FILE ACCESS   (A FULL DISCUSSION  OF THESE FEATURES APPEARS IN THE
1056 REM     NOTES TO MY PROGRAM 'PITTSBURGH PHIL', APC, APRIL 1986).  THE USER
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1057 REM      WHO WISHES TO DEVELOP  HIS/HER OWN  DATA EXTRACTION/INTERPRETATION
1058 REM      PROGRAMS FOR THE DATA BASE WHICH  'SHARE TRADER'  CREATES MAY LIKE
1059 REM      TO RETAIN THIS CODE,   SINCE IT CERTAINLY REDUCES DISK ACCESS TIME
1060 REM      AND GREATLY INCREASES DISK FILE CAPACITY.
1061 :
1062 REM  PLEASE NOTE THAT IT IS NOT POSSIBLE  TO USE THE EDIT OPTION TO CHANGE
1063 REM      THE NAME OF A STOCK DIRECTLY.  THIS IS A DELIBERATE OMISSION WHICH
1064 REM      TAKES ACCOUNT OF THE FACT THAT  THE INDEX FILE IS NEVER SORTED BUT
1065 REM      ACQUIRES ITS LEXICOGRAPHIC ORDER BY MERGING ENTRIES AS THEY ARRIVE
1066 REM      FROM THE KEYBOARD.    WHEN IT BECOMES NECESSARY TO RENAME A STOCK,
1067 REM      THE USER SHOULD  FIRST RAISE AN ENTRY  FOR THE STOCK UNDER ITS NEW
1068 REM      NAME AND THEN USE THE 'MERGE RECORDS' OPTION TO LINK BOTH  STOCKS'
1069 REM      HISTORIES INTO A SINGLE CHRONOLOGICAL CHAIN OF RECORDS  AND DELETE
1070 REM      THE OLD STOCK NAME FROM THE INDEX FILE AUTOMATICALLY.
1071 :
1072 REM  THE REMARKS ABOVE ALSO APPLY TO 'PITTSBURGH PHIL'.  IN THE NOTES THAT
1073 REM      WERE PUBLISHED WITH THAT PROGRAM,  I IMPLIED THAT THE  EDIT OPTION
1074 REM      COULD BE EMPLOYED TO ALTER A HORSE'S NAME DIRECTLY; THIS IS INDEED
1075 REM      NOT THE CASE.    'PITTSBURGH PHIL' USERS SHOULD ADOPT THE METHOD I
1076 REM      HAVE DESCRIBED IN THE PRECEDING PARAGRAPH TO ALTER AN INDEX ENTRY.
1077 :
1078 OPEN15,8,15:OPEN2,8,2,"-SHARE TRADER,P,W":INPUT#15,A:IFA=63THEN1081
1079 PRINT#2,CHR$(0)CHR$(192);:FORX=49152TO50243:READH$:D=0:FORY=1TO2
1080 A=ASC(MID$(H$,Y,1))-48:D=D#16+A+7*(A)9):NEXT:PRINT#2,CHR$(D);:NEXT
1081 CLOSE2:CLOSE15:IF0=0THEN1196
1082 GOTO1197
1083 :
1084 REM  FAST IN-MEMORY SORT (SEE 'ZIPSORT', APC MARCH 1986, PAGE 203) --------
1091 DATAA9,00,85,02,20,FD,AE,C9,41,F0,07,C9,44,F0,06,4C
1092 DATA08,AF,A9,00,2C,A9,80,8D,B6,C2,20,73,00,20,FD,AE
1093 DATAC9,30,F0,0C,C9,31,D0,E7,A9,40,0D,B6,C2,8D,B6,C2
1094 DATAA9,B7,85,FD,A9,C2,85,FE,20,73,00,20,79,00,F0,60
1095 DATAC9,2C,D0,CB,20,73,00,20,8B,B0,38,A5,47,E9,07,85
1096 DATA71,A5,48,E9,00,85,72,A0,04,B1,71,C9,01,F0,08,A2
1097 DATA00,2C,A2,16,4C,73,C2,C8,B1,71,A6,02,F0,05,CD,B5
1098 DATAC2,D0,EF,8D,B5,C2,C8,B1,71,A6,02,F0,05,CD,B4,C2
1099 DATAD0,E0,8D,B4,C2,A0,03,B9,45,00,91,FD,88,10,F8,18
1100 DATAA5,FD,69,04,85,FD,A5,FE,69,00,85,FE,E6,02,D0,9B
1101 DATAAD,B4,C2,D0,03,CE,B5,C2,CE,B4,C2,AD,B4,C2,8D,B2
1102 DATAC2,AD,B5,C2,8D,B3,C2,AD,B2,C2,C9,02,AD,B3,C2,E9
1103 DATA00,B0,01,60,4E,B3,C2,6E,B2,C2,38,AD,B4,C2,ED,B2
1104 DATAC2,8D,AC,C2,AD,B5,C2,ED,B3,C2,8D,AD,C2,A9,00,85
1105 DATA02,A2,FF,2C,B6,C2,50,01,E8,8E,B0,C2,8E,B1,C2,EE
1106 DATAB0,C2,D0,03,EE,B1,C2,AD,AC,C2,CD,B0,C2,AD,AD,C2
1107 DATAED,B1,C2,B0,06,A5,02,D0,D4,F0,AC,A2,03,BD,B7,C2
1108 DATA95,45,CA,10,F8,A5,47,85,58,A5,48,85,59,AD,B0,C2
1109 DATA85,71,AD,B1,C2,85,72,20,2A,B3,85,FB,84,FC,18,AD
1110 DATAB0,C2,6D,B2,C2,8D,AE,C2,AD,B1,C2,6D,B3,C2,8D,AF
1111 DATAC2,A2,03,BD,B7,C2,95,45,CA,10,F8,A5,47,85,58,A5
1112 DATA48,85,59,AD,AE,C2,85,71,AD,AF,C2,85,72,20,2A,B3
1113 DATA2C,B6,C2,30,51,24,45,30,1C,24,46,30,27,A5,FB,A4
1114 DATAFC,20,A2,BB,A5,47,A4,48,20,5B,BC,F0,02,10,03,4C
1115 DATAEF,C0,4C,04,C2,A0,01,B1,47,D1,FB,88,B1,47,F1,FB
1116 DATAB0,ED,90,EE,A0,02,B1,FB,99,4E,00,B1,47,99,51,00
1117 DATA88,10,F3,C8,C4,4E,B0,D7,C4,51,B0,D3,B1,4F,D1,52
1118 DATA90,CD,F0,EF,B0,CC,24,45,30,18,24,46,30,23,A5,47
1119 DATAA4,48,20,A2,BB,A5,FB,A4,FC,20,5B,BC,F0,B1,30,AF
1120 DATA10,32,A0,01,B1,FB,D1,47,88,B1,FB,F1,47,B0,A0,90
1121 DATA23,A0,02,B1,FB,99,4E,00,B1,47,99,51,00,88,10,F3
1122 DATAC8,C4,4E,B0,0C,C4,51,B0,08,B1,52,D1,4F,F0,F1,B0
1123 DATA03,4C,EF,C0,A9,01,85,02,A9,B7,85,14,A9,C2,85,15
1124 DATAA0,03,B1,14,99,45,00,88,10,F8,A5,47,85,58,A5,48
1125 DATA85,59,AD,B0,C2,85,71,AD,B1,C2,85,72,20,2A,B3,85
1126 DATA22,84,23,AD,AE,C2,85,71,AD,AF,C2,85,72,20,2A,B3
1127 DATA24,45,30,07,24,46,30,06,A0,04,2C,A0,01,2C,A0,02
1128 DATAB1,22,AA,B1,47,91,22,8A,91,47,88,10,F3,18,A5,14
1129 DATA69,04,90,02,E6,15,85,14,C5,FD,A5,15,E5,FE,90,A0
1130 DATA4C,EF,C0,BD,81,C2,F0,06,20,D2,FF,E8,D0,F5,4C,74
1131 DATAA4,0D,54,4F,4F,20,4D,41,4E,59,20,44,49,4D,45,4E
1132 DATA53,49,4F,4E,53,0D,00,0D,41,52,52,41,59,20,53,49
1133 DATA5A,45,53,20,44,49,46,46,45,52,0D,00,00,00,00,00
1134 DATA00,00,00,00,00,00,00,00,00,00,00,00
1135 :
1160 REM  CODE TO TEST FOR 'RESTORE', 'READ' AND 'MID$' ----------------------
1161 DATA20,73,00,08,C9,8C,F0,0C,C9,87,F0,2C,C9,CA,F0,70,28,4C,E7,A7
1162 :
1163 REM  CODE TO PERFORM 'RESTORE' (OLD AND NEW VERSIONS) -------------------
1164 DATA28,20,73,00,D0,06,20,1D,A8,4C,AE,A7,20,9E,AD,20,F7,B7,20,13,A6
1165 DATAA4,60,A6,5F,D0,01,88,CA,86,41,84,42,4C,AE,A7
1166 :
1167 REM  CODE TO PERFORM 'READ' AND 'READ#' ---------------------------------
1168 DATA28,20,73,00,C9,23,F0,06,20,06,AC,4C,AE,A7,20,9B,B7,20,1E,E1,20
1169 DATAFD,AE,20,9E,B7,8A,48,20,FD,AE,20,8B,B0,85,49,84,4A,20,A3,B6,68
1170 DATA20,75,B4,A0,02,B9,61,00,91,49,8B,10,F8,C8,20,12,E1,91,62,C8,C4
1171 DATA61,D0,F6,20,CC,FF,4C,AE,A7
1172 :
1173 REM  CODE TO ENABLE 'MID$' AS BOTH FUNCTION AND KEYWORD ----------------
1174 DATA28,20,73,00,20,FA,AE,20,8B,B0,85,64,84,65,85,49,84,4A,20,A3,B6
1175 DATAA0,00,B1,64,48,F0,2E,20,52,AA,A0,01,B1,49,85,05,C8,B1,49,85,06
1176 DATA20,FD,AE,20,9E,B7,8A,F0,17,CA,86,04,20,79,00,C9,29,D0,04,A9,FF
1177 DATAD0,0C,20,FD,AE,20,9E,B7,8A,D0,03,4C,48,B2,85,03,68,38,E5,04,C5
1178 DATA03,B0,02,85,03,20,F7,AE,A9,B2,20,FF,AE,20,9E,AD,20,A3,B6,A0,02
1179 DATAB1,64,85,51,88,B1,64,85,50,88,B1,64,F0,D3,C5,03,B0,02,85,03,A5
1180 DATA05,18,65,04,85,05,90,02,E6,06,A4,03,88,B1,50,91,05,C0,00,D0,F7
1181 DATA4C,AE,A7
1182 :
1183 REM  CODE TO PERFORM '£STR$' (SIMULATES MICROSOFT 'STRING$' FUNCTION) ----
1184 DATAA9,00,85,0D,20,73,00,C9,5C,F0,06,20,79,00,4C,8D,AE,20,73,00,C9
1185 DATAC4,F0,03,4C,08,AF,20,73,00,20,FA,AE,20,9E,B7,8A,48,20,FD,AE,20
1186 DATA9E,AD,24,0D,30,0C,20,AA,B1,A5,64,D0,24,A5,65,4C,16,C4,20,82,B7
1187 DATAF0,1A,A0,00,B1,22,85,03,68,20,7D,B4,A8,F0,07,A5,03,88,91,62,D0
1188 DATAFB,20,CA,B4,4C,F7,AE,4C,48,B2
1189 :
1190 REM  CODE TO ENGAGE THE FOREGOING FEATURES -------------------------------
1191 DATAA9,BB,A0,C2,8D,08,03,8C,09,03,A9,D1,A0,C3,8D,0A,03,8C,0B,03,60
1194 :
1195 REM  ENGAGE MACHINE CODE ROUTINES ----------------------------------------
1196 IF0=0THEN0=1:LOAD"-SHARE TRADER",8,1
1197 SYS50223:GOSUB2050
1198 :
1199 REM  DISPLAY MENU -------------------------------------------------------
1200 CLR:PRINTCHR$(142):OPEN1,0
1201 PRINT"[CLS]1. INPUT AND FILE NEW DATA":PRINT"2. VIEW A STOCK'S HISTORY"
1202 PRINT"3. EDIT A STOCK'S RECORD":PRINT"4. FORMAT NEW DATA DISK"
1203 PRINT"5. MERGE RECORDS":PRINT "6. DISPLAY INDEX":PRINT"7. EXIT PROGRAM"
1204 PRINT"[CD][CD]ENTER REQUIRED OPERATION (1-7): ";:INPUT#1,OP%:PRINT
1205 CLOSE1:ONOP%GOTO1300,1400,1500,1600,1700,1800,1900
1206 GOTO1200
1298 :
1299 REM  INPUT AND FILE NEW DATA --------------------------------------------
1300 CLR:GOSUB2030:GOSUB2000
1301 INPUT"HOW MANY STOCKS DO YOU WISH TO FILE TODAY";N%:DIMSH$(N%)
1302 OPEN1,0:FORX=1TON%:PRINT"[CD][CD]STOCK"X:PRINT:SH$(X)=£STR$(41," ")
1303 PRINT"STOCK NAME                : ";:INPUT#1,SN$:PRINT
1304 IF LEN(SN$)>16THENPRINT"NAME MUST NOT EXCEED 16 CHARACTERS!!!":GOTO1303
1305 PRINT"OPENING PRICE             : $";:INPUT#1,OP:PRINT:T=OP:GOSUB2150:OP$=T$
1306 PRINT"CLOSING PRICE             : $";:INPUT#1,CP:PRINT:T=CP:GOSUB2150:CP$=T$
1307 PRINT"SALES VOLUME IN HUNDREDS: ";:INPUT#1,SV%:PRINT
1308 MID$(SH$(X),1,16)=SN$:MID$(SH$(X),21,3)=DT$   :REM  THESE LINES SIMULATE
1309 MID$(SH$(X),24,5)=OP$:MID$(SH$(X),29,5)=CP$   :REM  THE 'LSET' AND 'RSET'
1310 MID$(SH$(X),34,4)=RIGHT$("     "+STR$(SV%),4):REM  COMMANDS OF STANDARD
1311 :                                              :REM  MICROSOFT BASIC.
1312 NEXT:CLOSE1:SYS49152,A,1,SH$(0):Z$=£STR$(16,"Z")
1313 FORX=1TON%:SN$=LEFT$(SH$(X),16):DT%=DT%+1:D$=RIGHT$("   "+STR$(DT%),4)
1314 GOSUB2020:GOSUB2090:IFFL%THENGOSUB2110:GOTO1316
1315 MID$(SH$(X),17,4)=D$:GOTO1318
1316 P%=ND%:GOSUB2100:READ#3,21,K$:GOSUB2110:IFND%THEN1316
1317 MID$(K$,18,4)=D$:GOSUB2100:PRINT#3,K$;
1318 P%=DT%:GOSUB2100:PRINT#3,RIGHT$(SH$(X),21);:IFFL%THENSH$(X)=Z$
1319 CLOSE3:CLOSE15:NEXTX:P%=0:GOSUB2080
1320 SYS49152,A,1,SH$(0)
1321 IFSH$(1)=Z$ORASC(SH$(1))=255THEN1325
1322 P%=P%+1:GOSUB2100:READ#3,20,K$:IFK$<SH$(1)THEN1322
1323 GOSUB2100:PRINT#3,LEFT$(SH$(1),20);:SH$(1)=K$:IFN%=1THEN1321
1324 GOTO1320
1325 CLOSE3:CLOSE15:IFP%THENIT%=P%
1326 GOSUB2070:GOTO1200
1398 :
```

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1399 REM  VIEW A STOCK'S HISTORY ----------------------------------------------
1400 CLR:GOSUB2140:GOSUB2130:GOSUB2090:GOSUB2110
1401 P%=ND%:GOSUB2100:READ#3,21,K$:GOSUB2120:PRINTTAB(4)DT$;
1402 PRINTTAB(15)OP$TAB(23)CP$TAB(32)SV$:GOSUB2110:IFND%THEN1401
1403 CLOSE3:CLOSE15:GOSUB2051:GOTO1200
1498 :
1499 REM  EDIT A STOCK'S HISTORY ----------------------------------------------
1500 GOSUB2140:GOSUB2090:GOSUB2110:LD%=ND%
1501 P%=ND%:GOSUB2100:READ#3,21,K$:GOSUB2120:SL%=SL%+1:IFSL%=1THENGOSUB2130
1502 IFSL%/20=INT(SL%/20)THEN1505
1503 Z=SL%:GOSUB2060:PRINTTAB(4)DT$;
1504 PRINTTAB(15)OP$TAB(23)CP$TAB(32)SV$:GOSUB2110:IFND%THEN1501
1505 PRINT"[CD]ENTER RECORD NUMBER AS SHOWN OR ZERO FORNEXT PAGE:";:K%=0
  1506 OPEN1,0:INPUT#1,K%:CLOSE1:PRINT:IFK%=0ANDND%=0THENCLOSE3:CLOSE15:GOTO1200
1507 IFK%=0THEN1501
1508 ND%=LD%:FORX=1TOK%:P%=ND%:LD%=P%:GOSUB2100:READ#3,21,K$
1509 GOSUB2110:NEXT:GOSUB2120:PRINT"[CLS][CD][CD][CD][CD][CD]1. DATE          : "
DT$
1510 PRINT"2. OPENING PRICE: "OP$:PRINT"3. CLOSING PRICE: "CP$
1511 PRINT"4. SALES VOLUME : "SV$:K$=£STR$(17," ")+RIGHT$(K$,4)
1512 INPUT"[CD][CD]EDIT WHICH FIELD (1-4)      [CL][CL][CL][CL][CL]";K%
1513 IFK%<1ORK%>4THENPRINT"[CU][CU][CU][CU]":GOTO1512
1514 FL%=1:ONK%GOSUB2000,1517,1519,1521:IFFL%THENSV$=LEFT$(SV$,LEN(SV$)-2)
1515 GOSUB2004:MID$(K$,1,3)=DT$:MID$(K$,4,5)=OP$:MID$(K$,9,5)=CP$
1516 MID$(K$,14,4)=SV$:P%=LD%:GOSUB2100:PRINT#3,K$;:CLOSE3:CLOSE15:GOTO1200
1517 OPEN1,0:PRINT"OPENING PRICE: $ ";:INPUT#1,OP:CLOSE1:PRINT
1518 T=OP:GOSUB2150:OP$=T$:RETURN
1519 OPEN1,0:PRINT"CLOSING PRICE: $ ";:INPUT#1,CP:CLOSE1:PRINT
1520 T=CP:GOSUB2150:CP$=T$:RETURN
1521 OPEN1,0:PRINT"VOLUME (100S): ";:INPUT#1,SV%:CLOSE1:PRINT
1522 SV$=RIGHT$("     "+STR$(SV%),4):FL%=0:RETURN
1598 :
1599 REM  FORMAT NEW DATA DISK ------------------------------------------------
1600 GOSUB2050:PRINT"[CD]THIS TAKES SEVERAL MINUTES - PLEASE STAND BY..."
1601 OPEN15,8,15,"N0:SHARE TRADER,ST":GOSUB2081:P%=100:GOSUB2100
1602 PRINT#3,CHR$(255):CLOSE3:GOSUB2091:P%=7700:GOSUB2100:PRINT#3,CHR$(255)
1603 INPUT#15,EM$:CLOSE3:CLOSE15:GOTO1200
1698 :
1699 REM  MERGE RECORDS (SEE PROGRAM HEADER NOTES) ----------------------------
1700 CLR:OPEN1,0:FL%=1:GOSUB2030
1701 SN$=£STR$(16," "):PRINT"[CD][CD]CORRECT NAME  : ";
1702 INPUT#1,K$:PRINT:MID$(SN$,1,16)=K$:GOSUB2020:IFFL%THEN1704
1703 PRINT"[CD]NO RECORD OF THAT NAME - TRY AGAIN.":GOTO1701
1704 GOSUB2110:CI%=P%:OC%=ND%:GOSUB2090
1705 CT%=CT%+1:P%=ND%:GOSUB2100:READ#3,21,K$:GOSUB2110:IFND%THEN1705
1706 CLOSE3:CLOSE15
1707 SN$=£STR$(16," "):PRINT"[CD]INCORRECT NAME: ";
1708 INPUT#1,K$:PRINT:MID$(SN$,1,16)=K$:GOSUB2020:IFFL%THEN1710
1709 PRINT"[CD]NO RECORD OF THAT NAME - TRY AGAIN.":GOTO1707
1710 CLOSE1:GOSUB2110:II%=P%:OI%=ND%:GOSUB2090
1711 CT%=CT%+1:P%=ND%:GOSUB2100:READ#3,21,K$:GOSUB2110:IFND%THEN1711
1712 DIMK$(CT%),PT%(CT%):ND%=OC%
1713 P%=ND%:GOSUB2100:AP%=AP%+1:READ#3,21,K$:K$(AP%)=K$:PT%(AP%)=ND%
1714 GOSUB2110:IFND%THEN1713
1715 ND%=OI%
1716 P%=ND%:GOSUB2100:AP%=AP%+1:READ#3,21,K$:K$(AP%)=K$:PT%(AP%)=ND%
1717 GOSUB2110:IFND%THEN1716
1718 CLOSE3:CLOSE15:SYS49152,A,1,K$(0):SYS49152,A,1,PT%(0)
1719 GOSUB2080:P%=CI%:GOSUB2100:READ#3,20,K$
1720 MID$(K$,17,4)=RIGHT$("     "+STR$(PT%(1)),4):P%=CI%:GOSUB2100
  1721 PRINT#3,K$;:FORX=II%+1TOIT%:P%=X:GOSUB2100:READ#3,20,K$:P%=X-1:GOSUB2100
1722 PRINT#3,K$;:NEXT:P%=IT%:GOSUB2100:PRINT#3,CHR$(255);:CLOSE3:CLOSE15
  1723 IT%=IT%-1:FORX=1TOCT%-1:MID$(K$(X),18,4)=RIGHT$("     "+STR$(PT%(X+1)),4)
1724 NEXT:MID$(K$(CT%),18,4)="    ":GOSUB2090:FORX=1TOCT%
  1725 P%=PT%(X):GOSUB2100:PRINT#3,K$(X);:NEXT:CLOSE3:CLOSE15:GOSUB2070:GOTO1200
1798 :
1799 REM  DISPLAY INDEX FILE IN SEQUENCE -------------------------------------
1800 CLR:FL%=1:GOSUB2030:PRINT"[CLS]":GOSUB2080:FORX=1TOIT%:P%=X:GOSUB2100
1801 READ#3,20,K$:PRINTRIGHT$("  "+STR$(P%),4),LEFT$(K$,16)
1802 NEXT:CLOSE3:CLOSE15:GOSUB2051:GOTO1200
1898 :
1899 REM  EXIT PROGRAM, LEAVING EVERYTHING AS WE FOUND IT ---------------------
1900 SYS64738
1998 :
1999 REM  CONVERT 'DDMMYY' TO Y-M-D VALUES ------------------------------------
2000 PRINT"[CLS]TRADING DATE (DDMMYY): ";:OPEN1,0:INPUT#1,DT$
2001 CLOSE1:PRINT:IFLEN(DT$)<>6THEN2000
2002 YY%=VAL(RIGHT$(DT$,2)):MM%=VAL(MID$(DT$,3,2)):DD%=VAL(LEFT$(DT$,2))
2003 IFDD%=0ORMM%=0ORYY%=0THEN2000
2004 DT$=CHR$(YY%)+CHR$(MM%)+CHR$(DD%):RETURN
2008 :
2009 REM  CONVERT Y-M-D TO DD MMM YY FOR SCREEN OUTPUT ------------------------
2010 DD%=ASC(MID$(K$,3,1)):MM%=ASC(MID$(K$,2,1)):YY%=ASC(K$)
2011 RESTORE2012:FORV=1TOMM%:READMM$:NEXT
2012 DATAJAN,FEB,MAR,APR,MAY,JUN,JUL,AUG,SEP,OCT,NOV,DEC
2013 DT$=RIGHT$(STR$(DD%),2)+" "+MM$+" "+RIGHT$(STR$(YY%),2)
2014 RETURN
2018 :
2019 REM  PERFORM BINARY SEARCH ON INDEX FILE ---------------------------------
2020 FL%=0:HI%=IT%:LO%=1:GOSUB2080
2021 P%=(HI%+LO%)/2:GOSUB2100:READ#3,20,K$
2022 IFSN$=LEFT$(K$,16)THENFL%=1:GOTO2026
2023 IFHI%<=LO%THEN2026
2024 IFSN$<LEFT$(K$,16)THENHI%=P%-1:GOTO2021
2025 LO%=P%+1:GOTO2021
2026 CLOSE3:CLOSE15:RETURN
2028 :
2029 REM  FETCH FILE TOTALS FROM BAM SECTOR -----------------------------------
2030 OPEN15,8,15:OPEN3,8,3,"#":PRINT#15,"UA:3 0 18 0"
2031 PRINT#15,"B-P:"3;248:READ#3,8,K$:CLOSE3:CLOSE15
2032 IT%=VAL(LEFT$(K$,4)):DT%=VAL(RIGHT$(K$,4)):IFFL%THENRETURN
2033 PRINT"[CD][CD]INDEX FILE HAS"100-IT%"RECORDS FREE":PRINT"HISTORY FILE ";
2034 PRINT"HAS"7700-DT%"RECORDS FREE":PRINT"[CD]IS THIS SUFFICIENT FOR THE ";
2035 PRINT"CURRENT RUN (Y/N)?":GOSUB2040:IFK$="N"THENCLR:GOTO1600
2036 RETURN
2038 :
2039 REM  FETCH Y/N RESPONSE --------------------------------------------------
2040 GETK$:IFK$<>"Y"ANDK$<>"N"THEN2040
2041 RETURN
2048 :
2049 REM  PROMPT FOR DATA DISK, ETC. -----------------------------------------
2050 PRINT"[CD][CD]INSERT DATA DISK AND PRESS <RETURN>.":GOTO2052
2051 PRINT"[CD][CD]PRESS <RETURN> TO CONTINUE..."
2052 POKE198,0:WAIT198,1:POKE198,0:RETURN
2058 :
2059 REM  FORMAT OPTION NUMBERS ----------------------------------------------
2060 PRINTRIGHT$(STR$(Z),2)". ";:RETURN
2068 :
2069 REM  WRITE FILE TOTALS ON BAM SECTOR -------------------------------------
2070 OPEN15,8,15:OPEN3,8,3,"#":PRINT#15,"UA:3 0 18 0"
2071 K$=RIGHT$("     "+STR$(IT%),4)+RIGHT$("     "+STR$(DT%),4)
2072 PRINT#15,"B-P:"3;248:PRINT#3,K$;:PRINT#15,"UB:3 0 18 0"
2073 CLOSE3:CLOSE15:RETURN
2078 :
2079 REM  OPEN INDEX FILE ----------------------------------------------------
2080 OPEN15,8,15
2081 OPEN3,8,3,"INDEX,L,"+CHR$(20):RETURN
2088 :
2089 REM  OPEN HISTORY FILE --------------------------------------------------
2090 OPEN15,8,15
2091 OPEN3,8,3,"HISTORY,L,"+CHR$(21):RETURN
2098 :
2099 REM  ALL-PURPOSE 'POSITION' COMMAND -------------------------------------
2100 PRINT#15,"P"CHR$(3+96)CHR$(P%AND255)CHR$(P%/256)CHR$(1):RETURN
2108 :
2109 REM  DECODE LINK TO NEXT RECORD -----------------------------------------
2110 ND%=VAL(RIGHT$(K$,4)):RETURN
2118 :
2119 REM  UNPACK INCOMING HISTORY RECORD -------------------------------------
2120 GOSUB2010:OP$=MID$(K$,4,5):CP$=MID$(K$,9,5)
2121 SV$=MID$(K$,14,4)+"00":IFVAL(SV$)=0THENSV$="
2122 RETURN
2128 :
2129 REM  PRINT HEADING -------------------------------------------------------
2130 PRINT"[CLS]"TAB(6)"DATE"TAB(15)"OPENED"TAB(23)"CLOSED   VOLUME"
2131 FORJ=1TO39:PRINTCHR$(163);:NEXT:PRINTCHR$(163):RETURN
2138 :
2139 REM  FETCH AND FORMAT STOCK'S NAME FOR INDEX FILE SEARCH -----------------
```

```
2140 FL%=1:GOSUB2030:SN$=£STR$(16," "):PRINT"[CD]NAME OF STOCK: ";:OPEN1,0
2141 INPUT#1,K$:CLOSE1:PRINT:MID$(SN$,1,16)=K$:GOSUB2020:IFFL%THENRETURN
2142 PRINT"[CD]NO RECORD OF THAT NAME - TRY AGAIN.":GOTO2140
2148 :
2149 REM  PRETTY UP THE DOLLARS AND CENTS FOR SCREEN DISPLAY
2150 T$=STR$(T):U=0:FORT=1TOLEN(T$):IFMID$(T$,T,1)="."THENU=T
2151 NEXT:IFU=0THENT$=T$+".00":GOTO2153
2152 IFT-U=2THENT$=T$+"0"
2153 T$=RIGHT$("      "+T$,5):RETURN
2198 :
2199 REM  IMPORTANT NOTE!!
2200 REM  THE PROGRAM HAS BEEN DESIGNED TO OPERATE ON PRE-EXTENDED FILES WHICH
2201 REM     IT HAS FORMATTED ITSELF FOR ITS OWN USE.  THIS IMPLIES THAT DISKS
2202 REM     WHICH ARE USED FOR THESE DATA FILES WILL HAVE ALL OTHER INFORMAT-
2203 REM     ION THEY MAY CONTAIN DESTROYED AT FORMATTING TIME.  THE USER MUST
2204 REM     THEREFORE PROVIDE FRESH DISKS FOR DATA,  AND THE FIRST TASK WHEN
2205 REM     USING THE PROGRAM FOR THE FIRST TIME  IS TO FORMAT A DISK FOR THE
2206 REM     DATA FILES  (OPTION 4 ON THE MENU).  THIS IS A LENGTHY PROCESS,
2207 REM     SINCE THE DISK IS  NOT ONLY FORMATTED  AT THIS TIME  BUT ALL FILE
2208 REM     RECORDS ARE ALSO WRITTEN AS DUMMIES TO ENSURE  THAT ALL THE SIDE
2209 REM     SECTOR POINTERS ARE COMPILED AND THAT SUBSEQUENT DISK ACCESS WILL
2210 REM     BE VERY MUCH FASTER AS A RESULT.
2211 :
2212 REM  IT IS PROBABLY WISE TO PROTECT THE DISK ON WHICH THE PROGRAM RESIDES
2213 REM     WITH  A  WRITE-PROTECT  STICKER  SO  THAT  INADVERTENT  SELECTION
2214 REM     OF OPTION 4 WILL NOT BE DISASTROUS.  IT IS ALSO A VERY GOOD IDEA
2215 REM     TO BACK UP THE DATA DISK AFTER EVERY RUN WHICH CHANGES THE FILES.
2216 :
2217 REM  WHENEVER THE PROGRAM IS RUN,  IT FIRST CHECKS THE PROGRAM DISK FOR A
2218 REM     MACHINE CODE FILE CALLED '-SHARE TRADER' WHICH CONTAINS CODE FOR
2219 REM     THE ROUTINES GIVEN IN LINES 1084-1191.  IF THE FILE IS PRESENT,
2220 REM     IT IS LOADED AND EXECUTION CONTINUES; IF IT IS NOT PRESENT, IT IS
2221 REM     CREATED ON THE PROGRAM DISK BY THE ROUTINE AT LINE 1078.  SINCE
2222 REM     THE DATA STATEMENTS ARE CODED IN HEXADECIMAL,  THIS PROCESS TAKES
2223 REM     A LITTLE TIME,  AND USERS  SHOULD NOT BE WORRIED  IF A DISK DRIVE
2224 REM     APPEARS TO 'HANG' DURING THIS PERIOD.  THE PROGRAM IS STILL WORK-
2225 REM     ING AND THE MAIN MENU WILL SOON BE SCREENED.

READY.
```

APC is interested in programs written in any of the major programming languages for all home and small business micros. When submitting programs please include a cassette or disk version of your program, brief but comprehensive documentation, and a listing on plain white paper — typed if you have no printer.

Please ensure that the software itself, the documentation and the listing are all marked with your name, address, program title, machine (along with any minimum requirements) and — if possible — a daytime phone number. Check through the previous Program listings to see the kind of programs we prefer. As a rough guide, original ideas are always welcome, as are good implementations of utilities and applications. Obviously the programs should be well-written, easy to understand, and preferably not too long (remember that other readers have to type them in).

All programs should be fully debugged and your own original, unpublished work. We prefer to receive programs with a maximum 80-column width printed in emphasised typeface.

We will try to return submissions if they are accompanied by a stamped addressed envelope of the appropriate size, but please keep a copy of everything. Programs are paid for at the rate of $20 per page of published listing.

Send to APC Programs, Att. Stephen Crawley, P.O. Box 666, Fitzroy 3065.

CHIP CHAT

CHIP CHAT

Award 1
This month's 'clutching at straws' award goes to Bordon Tkachuk for this quote, justifying the Atari's place in business, which appeared in *Business Review Weekly* recently: "It (*the Atari 520 ST — Ed*) meets a number of industry standards: it will connect to a standard IBM printer, it uses a standard communications port, and it supports the standard musical instrumentation digital interface." Bordon forgot to mention it also plugs into a standard power-point.

Brick-bats to *BRW* for printing this drivel.

Award II
We have two awards this month. The second — for the hyperbolic press release of the month — goes to Epson for its announcement of the Epson PC+, headed "Giant Leap in PC Technology". According to Epson, its "extremely advanced specifications" include a "powerful 360k floppy disk drive". Wow! And other features are an 8086 compatible microprocessor! Cor! It doesn't stop there, though: there are even five full length expansion slots. And so the statement goes on.

Yes, the Epson PC+ is a very nice machine; but a "Giant Leap"? No way.

Bad workmen blaming tools:
Now it can be told; the slump in the home micro market was all due to the customers, who were too stupid to know what they were doing and refused to buy home computers when they didn't know what to use them for.

This conclusion, very comforting for those many micro makers who have total contempt for their customers, is drawn by research firm Mintel in a recent report.

"Fuelled by media enthusiasm and a certain amount of hype, sales grew rapidly." says the report. "But little notice was taken of consumer needs."

Absolutely, and whose fault was that? The greed-obsessed manufacturers or retailers?

CHIP CHAT

No. "Consumer ignorance" is to blame for the downward slide of home computers.

However, later in the report, 64 per cent of these ignorami disagreed with the Mintel suggestion that "home computers are a flash in the pan," and 58 per cent of them also disagreed with the statement that "home computers are only useful for playing games."

So what do we conclude? That the customers are really keen on home computers, and want to use them for useful work at last.

And what does Mintel conclude? That "manufacturers and retailers will still face resistance from the consumer as long as they continue to remain ignorant."

Market research, yes. But logic?

A retinal reader writes:

"Sir, I hope your columnist's report of advances in "rectal pattern recognition" ("Chip-Chat", *APC* May) is a Freudian slip for "retinal pattern recognition", although the former would clearly be of fundamental importance. Mind you, the way the late 20th Century is turning out, I was inclined to take the author at face value on first reading.

Yours faithfully, M Daplyn.

A rectal columnist replies: Sorry. I must have been talking out of my retina.

Memo from Marketin

To: The chairman

From: Marketing dire tor (retired)

Re: Resignation

Well, sir, the rumours are true. It is no use shaking the golden handcuffs in my direction, no use whipping the md into rare activity to talk me out of it. I am sorry to say that I am leaving your employment forthwit , or even sooner.

It would be nice to say that it has been a pleasure to hawk your machin s round the gaggle of sycophants and gree -maddened no-hopers who comprise our dealer etwork. However, it has not.

Nor has it been un lloyed joy convincing our chinless salesmen to repeat, word-for-word, the script that I cobbled p in a Kings Cross drinking club one afternoon – a script whose contents could have won the Austra ian prize for fiction, by the way.

The advertising ag ncy will not be missed, nor will its denizens' pink sp ctacle frames and red Kickers. And as for the comp ter press, one remembers the immortal lines:

One cannot hope to bribe or twist,
Thank God, the A ussie journalist.
But seeing what he man will do
Unbribed, there's no occasion to.

I still think, thoug that it was worth a couple of lunches at Glo Glo's o get compliments about our case colour and pow rcord placement into the colour pages of the p iant press (the expenses claim will be in the post).

But as you trudge towards the Job Centre, sir, before you get your uango surprise at the Egg Marketing Board or wherever, I trust you will remember me with a fection.

Remember that yo are not so much losing a marketing director a gaining a bankruptcy hearing, and comfort yourself with the thought that microcomputers' los is the pet food business' gain. Yours in perpetuity a d Snappy Tom, James

END

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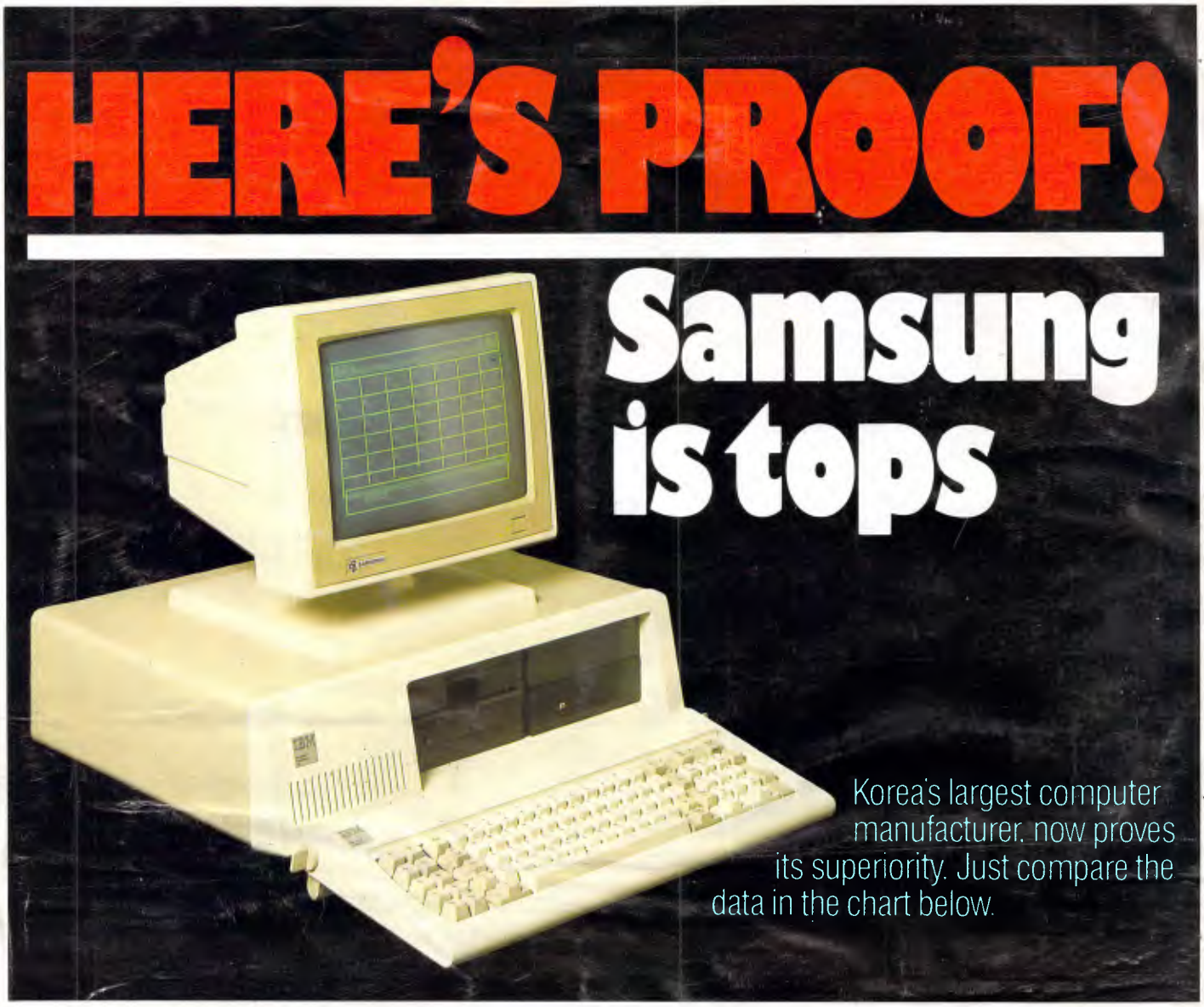

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ROLAND MA-122	$262.50	✗	✓	✓	20 Mhz	18.432 Khz	0°C to +40°C	7.0 kg	✗	✗	195 mm x 146 mm
QUBIE HR39	$320.00	✓	✓	✗	20 Mhz	18.432 Khz	−10°C to +50°C	9.8 kg	✗	✗	204 mm x 135 mm

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